Marion County

OREGON

BUSINESS SERVICES DEPARTMENT

Facilities Management Division

PROJECT MANUAL

Marion County Health Building
HVAC, Glazing, and Lighting Renovation and Tenant Improvements

August 31, 2015

75% Documents

PROJECT LOCATION:
3180 Center St NE, Salem, OR 97301

PROJECT REPRESENTATIVES:
Marion County Business Services - Facilities Management
555 Court Street NE, Room 4250
Salem, OR 97301

Architect/Engineer: SOLARC Engineering and Energy+Architectural Consulting
Represented by: Galen Ohmart, AIA 503-223-5253 galen@solarc-ae.net

Facilities Program Manager: Larry Tilford 503-576-7164 ltilford@co.marion.or.us

SECTION 00 01 10

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END OF SECTION

SECTION 00 43 22

UNIT PRICES FORM

PARTICULARS

THE FOLLOWING IS THE LIST OF UNIT PRICES REFERENCED IN THE BID SUBMITTED BY:

PROPOSER _____

CONTACT NAME: _____

PHONE: _____

SIGNATURE: _____

TO (OWNER): MARION COUNTY

DATED _____ AND WHICH IS AN INTEGRAL PART OF THE BID FORM.

THE FOLLOWING ARE UNIT PRICES FOR SPECIFIC PORTIONS OF THE WORK AS LISTED. ALL WORK DESCRIBED IN THE BID AND/OR CONTRACT DOCUMENTS SHALL BE INCLUDED IN THE LUMP SUM PRICE. THE UNIT PRICES GIVEN ARE APPLICABLE TO AUTHORIZED VARIATIONS FRON THE CONTRQACT DOCUMENTS ONLY. THESE VARIATIONS ARE LIMITED TO THOSE MADE BY CHANGE DIRECTIVE OR CHANGE ORDER SIGNED BY THE OWNER. UNIT PRICING WILL NOT BE A DIRECT FACTOR IN AWARDING THE BID. HOWEVER, UNIT PRICING SHALL BE BALANCED AND FAIR. UNBALANCED UNIT PRICES THAT COULD BE A DETRIMENT TO THE OWNER WILL BE REJECTED.

UNIT PRICE LIST

	SECTION	DESCRIPTION	UNITS	COST/UNIT
A.	03 30 00	Lean Concrete Slurry (Controlled Density Fill)	Cubic Yard	_____
B.	05 50 00	Metal Fabrications - Diagonal Bracing	Each	_____

END OF UNIT PRICES FORM

SECTION 00 43 23

ALTERNATES FORM

PARTICULARS

THE FOLLOWING IS THE LIST OF ALTERNATES REFERENCED IN THE PROPOSAL SUBMITTED BY:

PROPOSER NAME: _____

CONTACT NAME: _____

PHONE: _____

SIGNATURE: _____

TO (OWNER): MARION COUNTY

DATED _____ AND WHICH IS AN INTEGRAL PART OF THE PROPOSAL FORM.

ALTERNATES LIST

THE FOLLOWING AMOUNTS SHALL BE ADDED TO THE PROPOSAL AMOUNT. REFER TO SECTION 01 23 00 - ALTERNATES.

ALTERNATE # 1: PRESSURE WASH EXTERIOR CONCRETE SURFACES:
ADD $ _____

ALTERNATE # 2: REPLACE ALL ROUND HANDLED LATCH / LOCKSETS WITH LEVERED HANDLED LATCH / LOCKSETS:
ADD $ _____

ALTERNATE # 3: PROVIDE LUXURY VINYL TILE IN SUITE LOBBY SPACES:
ADD $ _____

END OF ALTERNATES FORM

SECTION 01 02 70
APPLICATIONS FOR PAYMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Required Schedule of Values submittal.

B. Procedures for preparation and submittal of Applications for Payment.

1.02 RELATED SECTIONS

A. Marion County Public Improvement Agreement: Contract Sum/Price and alternate prices and time schedule for submittals.

B. Marion County General Conditions: Progress Payments and Final Payment.

C. Section 01 02 80 - Change Order Procedures: Procedures for changes to the Work.

D. Section 01 30 00 - Submittals: Submittal procedures.

E. Section 01 70 00 - Contract Closeout: Final Payment.

1.03 SCHEDULE OF VALUES

A. WITHIN TEN (10) CALENDAR DAYS prior to submission of the first application for progress payment, submit to the Owner's Project Manager a Schedule of Values for the Project. Prepare Schedule of Values using standard format and procedures provided in Marion County General Conditions for Public Improvement Contracts.

1.04 FORMAT

A. AIA G702 - Application and Certificate for Payment including continuation sheets when required.

B. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit draft to Architect for approval.

C. For each item, provide a column for listing: Item Number; Description of Work; Scheduled Value, Previous Applications: Work in Place and Stored Materials under this Application: Authorized Change Orders; Total Completed and Stored to Date of Application; Percentage of Completion; Balance to Finish; and Retainage.

1.05 PREPARATION OF APPLICATIONS

A. Present required information in typewritten form or on electronic media printout.

B. Execute certification by signature of authorized officer.

C. Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of Work performed and for stored products.

D. List each authorized Change Order as an extension on continuation sheet, listing Change Order number and dollar amount as for an original item of Work.

E. Include Federal Tax Identification Number on all submitted Contract Payment Request forms.

F. Prepare Application for Final Payment as specified in Section 01 70 00.

1.06 SUBMITTAL PROCEDURES

A. Submit THREE copies of each Application for Payment, EACH COPY WITH ORIGINAL SIGNATURE(S) and EACH COPY NOTARIZED.

B. PAYMENT PERIOD:

1. Payment Period: The Owner shall make progress payments, per Marion County Public Improvement Agreement and Marion County General Conditions for Public Improvement Contracts, on the account of the Contract once monthly for the duration of the project (i.e. four (4) payments on a four-month project), based on the value of work accomplished or materials on the job-site, as stated in the schedule of values on the Application and Certificate for Payment. Retainage, in amount specified in the Agreement and General Conditions, to be calculated into the Application for Payment. Complete Application and

Certificate for Payment and forward to the Owner via the Owner's Project Manager on or about the 25th day of each month. A progress payment shall not be considered acceptance or approval of any Work or waiver of any defects therein.

2. Contractor shall submit applications to the Owner's Project Manager for each payment and, if required, receipts or other vouchers showing payments for materials and labor including payments to Subcontractors. Payments will be made on protected materials on hand at the job site properly stored, protected, and insured. Estimated quantities shall be subject to the Owner's Project Manager's review and judgement. Contractor shall include, in the application for payment, a schedule of the percentages of the various parts of the Work completed, based on the Schedule of Values which shall aggregate to the payment application total.
3. SUBMIT PAYROLL WAGE RATE CERTIFICATES WITH EACH APPLICATION FOR PAYMENT AND FOR THE SAME PERIOD OF TIME AS THE APPLICATION FOR PAYMENT.

1.07 EARLY PURCHASE AND PAYMENT OF MATERIALS AND EQUIPMENT

A. Order materials and equipment requiring a long lead or waiting time early so as not to delay progress of the Work.

B. The Contractor will be reimbursed for early order of materials or items, in accordance with Marion County Public Improvement Agreement Form and Marion County General Conditions for Public Improvement Contracts, upon receipt and verification of quality and quantity against submittals and shipping documents by the Contracting Officer's Representative. Receipt shall be to the job site, stored at the Owner's premises or at a location off site approved by the Owner's Project Manager that is properly bonded and insured. Early order material to be stored in an orderly and safe manner, secured from weather damage. Security remains the responsibility of the Contractor.

1.08 SUBSTANTIATING DATA

A. When the Owner's Project Manager requests substantiating information, submit data justifying dollar amounts in question. Data shall include a breakdown of dollar amounts by labor, material, profit & overhead. Failure to do so will delay payment of any portion of the pay request.

B. Provide one copy of data with cover letter for each copy of submittal. Show Application number and date, and line item by number and description.

PART 2 PRODUCTS

2.01 NOT USED

PART 3 EXECUTION

3.01 NOT USED

END OF SECTION

SECTION 01 02 80

CHANGE ORDER PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Submittals.

B. Documentation of change in Contract Sum/Price and Contract Time.

C. Change procedures.

D. Construction Change Directive.

E. Stipulated Sum change order.

F. Execution of change orders.

G. Correlation of Contractor submittals.

H. Percentage allowances for Contractor's overhead and profit.

1.02 RELATED SECTIONS

A. Marion County Public Improvement Agreement: Standard Form of Agreement for Construction.

B. Marion County General Conditions for Public Improvement Contracts: Administration of the Contract, including requirements for changes in the Work, in Contract Sum/Price, and Contract Time.

C. Marion County General Conditions for Public Improvement Contracts: Percentage allowances for Contractor's overhead and profit.

D. Section 01 02 70 - Applications for Payment: Procedure for including authorized Change Orders in payment application.

E. Section 01 30 00 - Submittals: Work schedule.

F. Section 01 30 00 - Submittals: Schedule of values.

G. Section 01 60 00 - Material and Equipment: Product options and substitutions.

H. Section 01 70 00 - Contract Closeout: Project record documents.

1.03 SUBMITTALS

A. Submit name of the individual authorized to receive change documents, and be responsible for informing others in Contractor's employ or Subcontractors of changes to the Work.

B. Change Order Forms: AIA G701 Change Order including continuation sheets when required.

1.04 DOCUMENTATION OF CHANGE IN CONTRACT SUM/PRICE AND CONTRACT TIME

A. Maintain detailed records of work done. Provide full information required for evaluation of proposed changes, and to substantiate costs of changes in the Work.

B. Document each quotation for a change in cost or time with sufficient data to allow evaluation of the quotation.

C. Provide data to support computations:
   1. Quantities of products, labor, and equipment.
   2. Taxes, insurance, and bonds.
   3. Overhead and profit.
   4. Justification for any change in Contract Time.
   5. Credit for deletions from Contract, similarly documented.

1.05 CHANGE PROCEDURES

A. The Owner's Project Manager will advise of minor changes in the Work not involving an adjustment to Contract Sum/Price or Contract Time as authorized by the General Conditions, by issuing Supplemental Instructions.

B. The Owner's Project Manager may issue a Proposal Request which includes a detailed description of a proposed change with supplementary or revised Drawings and specifications, a change in Contract Time for executing the change and the period of time during which the requested price will be considered valid. Contractor will prepare and submit an estimate within thirty (30) calendar days.

C. The Contractor may propose a change by submitting a request for change to the Owner's Project Manager, describing the proposed change and its full effect on the Work, with a statement describing the reason for the change, and the effect on the Contract Sum/Price and Contract Time with full documentation and a statement describing the effect on Work by separate or other contractors. Document any requested in accordance with Section 016000.

1.06 CONSTRUCTION CHANGE DIRECTIVE

A. Owner's Project Manager may issue a document instructing the Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

B. The document will describe changes in the Work, and will designate method of determining any change in Contract Sum/Price or Contract Time.

C. Promptly execute the change in Work.

D. A Construction Change Directive will be issued by the Owner's Project Manager, per the General Conditions, if necessary to enact Change Order work.

1.07 STIPULATED SUM CHANGE ORDER

A. Based on Proposal Request and Contractor's fixed price quotation or Contractor's request for a Change Order as approved by Owner's Project Manager. Documentation will be prepared by the Owner's Project Manager in accordance with the Marion County Public Improvement Agreement Form.

B. Hourly labor rates submitted by the Contractor shall indicate a breakdown of each rate according to wages, benefits, profit, and overhead.

1.08 EXECUTION OF CHANGE ORDERS

A. Execution of Change Orders: Owner's Project Manager will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.

1.09 CORRELATION OF CONTRACTOR SUBMITTALS

A. Promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Sum/Price.

B. Promptly revise progress schedules to reflect any change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.

C. Promptly enter changes in Project Record Documents.

1.10 PERCENTAGE ALLOWANCES

A. The maximum allowance for overhead and profit combined, included in the total cost to the Owner, shall be based on the Marion County Public Improvement Agreement Form and Marion County General Conditions for Public Improvement Contracts.

B. BOND AND INSURANCE COSTS ATTRIBUTED TO A CHANGE IN THE CONTRACT SUM AND/OR SCOPE OF WORK SHALL BE INCLUDED AS A PART OF THE PERCENTAGES INDICATED ABOVE AS MAXIMUM ALLOWANCE FOR PROFIT AND OVERHEAD.

PART 2 PRODUCTS

2.01 NOT USED

PART 3 EXECUTION

3.01 NOT USED

END OF SECTION

SECTION 01 04 10

PROJECT COORDINATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Construction mobilization.

B. Project security requirements.

C. Schedules/sequencing/phased Work.

D. Submittals.

E. Project progress meetings.

F. Closeout procedures.

1.02 RELATED SECTIONS

A. General Conditions For Construction Project: Preconstruction conference.

B. Section 01 10 00 - Summary: Work sequence and Owner occupancy.

C. Section 01 70 00 - Execution and Closeout Requirements: Contract closeout procedures.

1.03 CONSTRUCTION MOBILIZATION

A. Pre-Job Meeting (Mandatory):

1. A pre-job meeting will be conducted at the job site prior to start up. The selected Contractor shall notify all parties involved with project, including sub-contractors, Owner's representative, City of Salem Fire Marshal, and City of Salem Building Inspector, a minimum of eight (8) working days prior to the scheduled meeting.
2. Meeting will not be conducted until all applicable submittal requirements are met and approved.

B. Cooperate with the Owner’s Project Manager in allocation of mobilization area for site; for field offices and sheds, for building access/security, traffic, and parking facilities. See SUMMARY, Section 01 0100, and TEMPORARY FACILITIES AND CONTROLS, Section 01 5000, and drawings for additional information.

C. During construction coordinate use of the site, existing building, and any other facilities with the Owner’s Project Manager.

D. Comply with the instructions of the Owner’s Project Manager for the use of temporary utilities and construction facilities.

E. Comply with Owner’s Project Manager procedures for intra-project communications; submittals, reports and records, schedules, coordination drawings, and recommendations; and resolution of ambiguities and conflicts.

1.04 SECURITY

A. Marion County requires a criminal background check of all contractors, workers and helpers on projects associated with Marion County Buildings. No person with a felony conviction appearing on their record or as deemed as a security risk by any of the regulating authorities will be allowed to work on this project.

B. Contractor shall fill out background information form supplied by Facilities Management and have it signed and notarized.

C. A list of all on-site employees is required to be submitted prior to an employee being on the job-site. This list must be updated immediately and prior to any new employees working on the site.

1. This requirement applies to all sub-contractors and anyone else that the General Contractor requires during the entire course of the project.

D. Any keys or access cards issued to authorized construction personnel for after hour work are to be used for the sole purpose of accessing the project site for execution of the project work. No

authorized construction personnel shall unlock doors to allow any other person into the project site.

1.05 SCHEDULES

A. Submit preliminary progress schedule, Work sequencing, and phased Work plan in accordance with Sections 01 30 00 and 01 31 00.

B. After review by the Owner's Project Manager revise and resubmit schedule to comply with revised Project schedule.

C. Contractor shall provide a crew large enough to complete the project in a timely manner and stay within submitted and approved schedule.

D. During progress of Work, revise and resubmit schedule with Applications for Payment.

1.06 SUBMITTALS

A. Submit shop drawings, product data and samples in accordance with Section 01 30 00 for review and compliance with Contract Documents, for field dimensions and clearances, for relation to available space, and for relation to Work of separate contracts. Revise and resubmit as required.

B. FAILURE TO SUBMIT SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES AS SPECIFIED HEREIN SHALL RESULT IN WITHHOLDING OF A PORTION OF THE CONTRACT SUM TO ACCOUNT FOR FAILURE TO FULFILL CONTRACT OBLIGATIONS.

C. Submit AIA G702, including continuation sheets when required, to the Owner.

D. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit draft to Architect for approval.

E. Submit requests for interpretation of Contract Documents, and obtain instructions from the Owner's Project Manager.

F. Process requests for substitutions, and change orders, through the Owner's Project Manager.

G. Deliver closeout submittals for review and preliminary inspection reports to the Owner's Project Manager.

1.07 COMPUTER AIDED DRAFTING (CAD) DRAWINGS

A. CAD files of the Contract Drawings are available from the Architect for use by the Contractor in the execution of Work, or for reproduction for the purposes of this project only under the following provisions:
   1. Contractor to Pay The Architect the cost of reproduction and electronic media.
   2. Drawings are in AUTOCAD format. Architect makes no representation as to the compatibility of the CAD drawings/files with any hardware or software.
   3. All information on the CAD drawings/files is considered instruments of service of the Architect and shall not be used for other projects, for additions or modifications to this project, or completion of this project by others. CAD files remain the property of the Architect and in no case is the transfer of these files a sale.
   4. Architect makes no representation regarding the accuracy, completeness, or permanence of the CAD files, nor for fitness for any purpose whatsoever. The files do not represent a Contract.

1.08 PROJECT PROGRESS MEETINGS

A. Project progress meetings will be scheduled and required on a regular basis at a mutually agreed time, place, and day. Meetings will be attended by the Contractor and Owner's Project Manager.

B. Project progress meetings may be canceled on a case by case basis as mutually agreed by the Contractor and Owner's Project Manager.

1.09 CLOSEOUT PROCEDURES

A. Notify the Owner's Project Manager IN WRITING when Work is considered ready for Substantial Completion.

B. Comply with Owner's Project Manager instructions to correct items of Work listed in executed Certificates of Substantial Completion.

C. Notify the Owner's Project Manager IN WRITING when Work is considered finally complete.

D. Comply with instructions for completion of items of Work determined by the Owner's Project Manager final inspection.

PART 2 PRODUCTS

2.01 NOT USED

PART 3 EXECUTION

3.01 NOT USED

END OF SECTION

SECTION 01 04 50
CUTTING AND PATCHING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements and limitations for cutting and patching of Work.

1.02 RELATED SECTIONS

A. Marion County General Conditions: Job Site Conditions.

B. Section 01 10 00 - Summary.

C. Section 01 30 00 - Submittals.

D. Section 01 60 00 - Product Requirements: Product Options and Substitutions.

E. Individual Product Specification Sections:
   1. Cutting and patching incidental to Work of the Section.
   2. Advance notification to other Sections of openings required in Work of those Sections.
   3. Limitations on cutting structural members.

1.03 SUBMITTALS

A. Submit written request in advance of cutting or alteration which affects:
   1. Structural integrity of any element of Project.
   2. Integrity of weather-exposed or moisture resistant element.
   3. Efficiency, maintenance, or safety of any operational element.
   4. Visual qualities of sight exposed elements.

B. Include in request:
   1. Identification of Project.
   2. Location and description of affected Work.
   3. Necessity for cutting or alteration.
   4. Description of proposed Work, and products to be used.
   5. Alternatives to cutting and patching.
   6. Effect on Work of Owner or separate contractor.
   7. Written permission of affected separate contractor.
   8. Date and time Work will be executed.

PART 2 PRODUCTS

2.01 MATERIALS

A. Primary Products: Those required for original installation.

B. Product Substitution: For any proposed change in materials, submit request for substitution under provisions of Section 01 60 00.

PART 3 EXECUTION

3.01 EXAMINATION

A. Inspect existing conditions prior to commencing Work, including elements subject to damage or movement during cutting and patching.

B. After uncovering existing Work, inspect conditions affecting performance of Work.

C. Beginning of cutting or patching means acceptance of existing conditions.

D. DO NOT CUT ANY JOIST, HEADER, RAFTER, BEAM, COLUMN OR ANY OTHER STRUCTURAL MEMBER, UNLESS SPECIFICALLY INDICATED ON THE DRAWINGS, WITHOUT PRIOR APPROVAL OF THE OWNER'S PROJECT MANAGER.

E. OBTAIN WRITTEN APPROVAL FROM OWNER'S PROJECT MANAGER PRIOR TO DRILLING HOLES IN WALLS, ROOFS OR CEILINGS

3.02 PREPARATION

A. Provide temporary supports to ensure structural integrity of the Work. Provide devices and methods to protect other portions of Project from damage.

B. Provide protection from elements for areas which may be exposed by uncovering Work.

C. Maintain excavations free of water.

3.03 CUTTING AND PATCHING

A. Execute cutting, fitting, and patching including excavation and fill, if any, to complete Work.

B. Fit products together, to integrate with other Work.

C. Uncover Work to install improperly sequenced Work.

D. Remove and replace defective or non-conforming Work.

E. Provide openings in the Work for penetration of mechanical and electrical Work.

3.04 PERFORMANCE

A. Execute Work by methods to avoid damage to other Work, and which will provide appropriate surfaces to receive patching and finishing.

B. Employ original installer or equally qualified person as original installer to perform cutting and patching for weather exposed and moisture resistant elements, and sight-exposed surfaces.

C. Cut rigid materials using appropriate means for the type of material. Protect surroundings and clean up all debris, including dust. Pneumatic tools not allowed without prior approval.

D. Restore Work with new products in accordance with requirements of Contract Documents.

E. Fit Work tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces. Provide sealant or fire rated sealant at penetrations through surfaces for pipes, sleeves, ducts, conduit, or any other penetrations.

F. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material that maintains fire rating integrity of penetrated component.

G. Refinish surfaces to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.

END OF SECTION

SECTION 01 09 00
REFERENCE STANDARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Reference Standards applicable to this project.

1.02 QUALITY ASSURANCE

A. For products or workmanship specified by association, trade, or Federal Standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. The contractual relationship of the parties to the Contract shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.03 REFERENCED STANDARDS

A. General Applicability:
   1. Unless otherwise shown referenced items without listed date shown are latest issue.
   2. Published standards for materials and operations specified by reference require compliance.
   3. In case of conflict between referenced standards and project specifications, project specifications govern.
   4. Except to extent of more explicit stringent requirements written directly into Contract Documents, or are required by governing regulations, applicable standards of construction industry have same force and effect for Work (and are made a part of Contract Documents by reference) as if copied directly into contract documents or as if published copies are bound herein.
   5. Referenced standards take preference over standards that are not referenced but recognized in construction industry as applicable.
   6. Where an industry standard compliance is required, standard in effect as of date of Contract Documents applies, unless shown otherwise.

PART 2 PRODUCTS

2.01 NOT USED

PART 3 EXECUTION

3.01 NOT USED

END OF SECTION

SECTION 01 10 00

SUMMARY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Contractor use of site and premises.

B. Work Sequence.

1.02 RELATED SECTIONS

A. Section 01 50 00 - Temporary Facilities and Controls.

B. Marion County General Conditions: Administration of Contract and Schedule of Work.

1.03 SUMMARY OF WORK

A. Marion County intends to award a contract to highest qualified proposer for the Marion County Health Building HVAC, Glazing, and Lighting Replacement at the existing Health Building located at 3180 Center St NE, Salem, OR 97301.

B. Generally, the Work under this contract includes:
   1. Replacement of exterior storefront and curtainwall.
   2. Replacement of entire HVAC system.
   3. Replacement of entire lighting system.
   4. Substantial tenant improvements to the first floor and modest tenant improvements to the second and third floors, focusing on ADA restrooms and lobby redesign.
   5. New floor and wall finishes throughout the facility.

C. Work shall be started within fifteen (15) calendar days after signing of an Agreement with the Owner. The Agreement may not be signed prior to approval of the Contractor's Certificate of Insurance by the Owner. The project shall be completed within the calendar day time frame indicated by the Contractor on the Proposal Form.

D. Marion County will pay for permit fees. Contractor is responsible for picking up all required permits necessary to complete this project from the City of Salem Permit Office and shall have copies on the job site at all times during the project. Contractor is also responsible for submitting all deferred submittals to the City of Salem Permit Office including, but not limited to, mechanical equipment cut sheets, seismic restraint calculations, and roof curb engineering. Refer to individual sections for specific deferred submittal requirements.
   1. The contractor is responsible for all fines, or other ramifications for not complying with this instruction.

1.04 CONTRACTOR USE OF SITE AND PREMISES

A. Access to Site: Limit movement on and off the site for work as indicated on the Drawings or as agreed to with Owner's Project Manager.

B. Construction Operations: Limited to areas noted on Drawings; coordinate additional needs with the Owner's Project Manager. The Contractor shall not damage existing vegetation unless noted for work on the drawings. The Contractor shall not damage: existing building components not indicated for work in this project, utility lines, or electrical service lines unless noted for work on the drawings.
   1. In the event the Contractor damages existing building components or existing utility services the Contractor will, at the Owner's discretion, replace/repair the damaged materials or be assessed a charge by the Owner for such damages.
   2. In the event damage occurs to an underground system as a direct result of a Contractor's activities, the Contractor shall repair/replace or be assessed a charge at the discretion of the Owner. If repairs are to be made by the Contractor, such repairs shall be inspected by the Owner's Project Manager or the Owner's agent prior to backfilling. Any galvanized pipe that requires repair shall be repaired at a threaded coupling, not by use of a compression coupling.

C. The Contractor shall protect sidewalks, asphalt paving, concrete, trees, shrubs, and lawn areas at all times from spillage of materials used in carrying out the work. Prevent materials from clogging catch basins and yard drains; leave drains clean and in proper working conditions at all times.
   1. In the event the Contractor damages plant material with equipment or personnel, the Contractor will, at the Owner's discretion, replace/repair the damaged materials or be assessed a charge by the Owner for such damages.

D. Parking or Driving on Lawn Areas: The Owner forbids parking or driving on all lawn areas.
   1. When it becomes necessary, in accordance with the scope of work, to traverse a lawn area, the Contractor shall place plywood on the area to be driven on. The plywood shall be of sufficient thickness and width to support vehicles and prevent rutting of the lawns. Care shall also be taken with respect to existing lawn sprinkler heads (if any).

E. Utility Outages and Shutdown: Inform the Owner's Project Manager 72 hours prior to any utility outages or shutdowns which will affect the existing building.

1.05 ASBESTOS AND OTHER HAZARDOUS MATERIAL

A. If during the course of the Contract, the Contractor observes or suspects the existence of hazardous materials in the structure, components of the building, or site the Contractor shall immediately stop work and notify the Owner's Project Manager. The Owner will arrange for the removal of hazardous materials as required by Owner personnel or by separate contract. Should hazardous materials be found in the area of work the Contractor will be required to schedule ten (10) days of slack or "down" time for the removal of hazardous materials without penalty to the Owner for the delay of the Contract.

1.06 WORK SEQUENCE

A. Construct Work using methods, techniques, and scheduling advantageous to swift completion. Review proposed sequence and scheduling with the Owner's Project Manager for approval prior to commencing work.

1.07 EXISTING CONDITIONS AND DIMENSIONS

A. Field verify existing conditions prior to proposal opening. Request clarification from the Owner's Project Manager for conditions found that are in conflict with information shown on the drawings or specified prior to proposal opening.

B. Field verify existing dimensions/measurements prior to proposal opening. Do not scale measurements or dimensions from the Drawings. Proposal errors resulting from scaled measurements and/or dimensions shall be solely the responsibility of the Proposer.

C. Field verify dimensions of new openings, new construction, and new equipment/devices prior to ordering any material components subject to field dimensions. Successful proposer is responsible for dimensions which shall be confirmed and correlated at the project site for compatibility with project components.

D. Project components ordered or obtained for incorporation with the work that are not compatible with verified dimensions shall be solely the responsibility of the successful Proposer.

E. Field verify existing structure materials prior to proposal opening. Request clarification from the Owner's Project Manager for materials found that are in conflict with information shown on the drawings or specified prior to proposal opening. Proposal errors resulting from failure to field verify existing structure materials shall be solely the responsibility of the Proposer.

1.08 INFEASIBLE WORK

A. If work is required in a manner to make it impossible to produce first class work or should discrepancies appear among Contract Documents, make a written request for interpretation before proceeding with Work. If Contractor fails to make such written request, no excuse will there-after be entertained for failure to carry out work in satisfactory manner.

B. If work is shown in the Contract Documents that is not possible to complete, or deletion/addition of work in one area makes it impossible or infeasible to complete work in another area, make a

written request for interpretation before proceeding with further work. If Contractor fails to make such written request, no excuse will thereafter be entertained for failure to carry out work in satisfactory manner.

C. Means and methods of construction are solely the responsibility of the Contractor. Proposed means and methods that are deemed infeasible by site conditions, other than concealed conditions, shall be the sole responsibility of the Contractor. The Owner shall not compensate the Contractor for changes to means and methods determined infeasible by existing site conditions, other than concealed conditions.

PART 2 PRODUCTS

2.01 NOT USED

PART 3 EXECUTION

3.01 NOT USED

END OF SECTION

SECTION 01 12 00
ALTERATION PROJECT PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Products and installation for patching and extending Work.

B. Transition and adjustments.

C. Repair of damaged surfaces, finishes, and cleaning.

D. Procedure for addressing hazardous materials.

1.02 RELATED SECTIONS

A. Marion County General Conditions: Administration of the Contract and Job Site Conditions.

B. Section 01 04 10 - Project Coordination: Work scheduling, sequence, and phases.

C. Section 01 04 50 - Cutting and Patching: Cutting and patching.

PART 2 PRODUCTS

2.01 PRODUCTS FOR PATCHING AND EXTENDING WORK

A. New Materials: As specified in product Sections; match existing Products and Work for patching and extending Work.

B. Type and Quality of Existing Products: Determine by inspection and testing Products where necessary, referring to existing Work as a standard.

2.02 RE-USE OF EXISTING MATERIALS AND PRODUCTS

A. Unless otherwise noted on drawings do not re-use existing materials or products for patching and extending Work; do not re-use existing equipment unless noted on drawings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that demolition is complete, and areas are ready for installation of new Work.

B. Beginning of remodeling/alteration Work means acceptance of existing conditions.

3.02 PREPARATION

A. Cut, move, or remove items as necessary for access to alterations and renovation Work. Replace and restore at completion all previously cut, moved, or removed items.

B. Remove unsuitable material not marked for salvage, such as rotted wood, corroded metals, and deteriorated masonry and concrete, notifying Owner's Project Manager prior to removal for inspection and approval.

C. Remove debris and abandoned items from areas of work and from concealed spaces.

D. Prepare surface and remove surface finishes to provide for proper installation of new Work and finishes.

E. Close openings in exterior and/or interior surfaces to protect existing Work from weather and extremes of temperature and humidity. Insulate duct Work and piping to prevent condensation in exposed areas.

3.03 INSTALLATION

A. Coordinate Work of alterations and renovations to expedite completion, to accommodate Owner occupancy, and minimize disruption of existing building ingress and egress.

B. Designated areas, Rooms and spaces and Finishes: Complete in all respects including operational mechanical, electrical, and plumbing Work.

C. Remove, cut, and patch Work in a manner to minimize damage and to provide a means of restoring Products and finishes to original or specified condition.

D. Refinish visible existing surfaces to remain in renovated rooms and spaces, to original or specified condition for each material, and original relationship to adjacent finishes.

E. In addition to specified replacement or removal of equipment and fixtures, restore existing plumbing, heating, ventilation, air conditioning, electrical, security systems, fire sprinkler, landscape, and all areas affected by work to full operational condition.

F. Install Products as specified in individual Sections.

3.04 TRANSITIONS

A. Where new Work abuts or aligns with existing, perform a smooth and even transition. Patched Work to match existing adjacent Work in texture and appearance.

B. When finished surfaces are cut so that a smooth transition with new Work is not possible, terminate existing surface along a straight line at a natural line of division and make recommendation and get approval by the Owner's Project Manager.

3.05 ADJUSTMENTS

A. Where a change of plane of 1/4 inch or more occurs, request instructions from Owner's Project Manager.

B. Fit Work at penetrations of surfaces as specified in Section 01 04 50.

3.06 REPAIR OF DAMAGED SURFACES

A. Patch or replace portions of existing surfaces affected by work area which are damaged, lifted, discolored, or showing other imperfections.

B. Repair substrate prior to patching finish.

3.07 FINISHES

A. Finish surfaces as specified in individual Product Sections.

B. Finish patches to product uniform finish and texture over entire area. When finish cannot be matched, refinish entire surface to nearest intersections.

3.08 HAZARDOUS MATERIALS

A. Hazardous materials such as asbestos, asbestos products, polychlorinated biphenyl (PCB) or other toxic substances shall not be allowed on the site nor be used in the Work. The Contractor shall notify the Owner's Project Manager immediately and stop Work in the area affected if any one of the products or materials specified in the Contract Documents or proposed by the Contractor or subcontractors or material suppliers or encountered on the job site contain or are suspected to contain hazardous materials in any form, so that a qualified consultant retained by the Owner can determine whether such materials may be used in the Work or need to be removed from the site or rendered harmless in a manner which will not adversely affect the health of any person and which will comply with applicable governmental laws and regulations. Work in the affected area shall be resumed in the absence of any hazardous materials or when it has been rendered harmless by written agreement between Contractor and Owner.

3.09 CLEANING

A. In addition to cleaning specified in Section 01 70 00, clean Owner occupied areas of Work at the end of each working day per Section 01 50 00.

END OF SECTION

SECTION 01 20 00

PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cash allowances.

B. Contingency allowances.

C. Schedule of values.

D. Applications for payment.

E. Change procedures.

F. Defect assessment.

G. Unit prices.

H. Alternates.

1.02 RELATED SECTIONS

A. Marion County General Conditions: Payments.

1.03 CASH ALLOWANCES

A. Costs Included in Cash Allowances: Cost of product to Contractor or Subcontractor, labor for installation and finishing; less applicable trade discounts; and delivery to site.

B. Costs Not Included in Cash Allowances But Included in Contract Sum/Price: Product delivery to site and handling at site, including unloading, uncrating, and storage; and protection of products from elements and from damage.

C. Owner's Project Manager Responsibilities:
   1. Consult with Contractor for consideration and selection of products, suppliers, and installers.
   2. Select products in consultation with Owner and transmit decision to Contractor.
   3. Prepare Change Order.

D. Contractor Responsibilities:
   1. Assist Owner's Project Manager in selection of products, suppliers and installers.
   2. Obtain proposals from suppliers and installers and offer recommendations.
   3. On notification of selection by Owner's Project Manager, execute purchase agreement with designated supplier and installer.
   4. Arrange for and process shop drawings, product data, and samples. Arrange for delivery.
   5. Promptly inspect products upon delivery for completeness, damage, and defects. Submit claims for transportation damage.

E. Differences in costs will be adjusted by Change Order.

1.04 SCHEDULE OF VALUES

A. Submit printed schedule on AIA Form G703 - Continuation Sheet for G702.

B. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit draft to Architect for approval.

C. Submit Schedule of Values in duplicate within 10 calendar days after date of Notice to Proceed per Marion County Public Improvement Agreement Form and Marion County General Conditions for Public Improvement Contracts.

D. Format: Utilize Table of Contents of this Project Manual. Identify each line item with number and title of major specification Section. Identify site mobilization, bonds and insurance, and all other General Conditions costs.

E. Include in each line item, amount of Allowances specified in this section. [For unit cost Allowances, identify quantities taken from Contract Documents multiplied by unit cost to achieve total for each item.]

F. Include separately from each line item, direct proportional amount of Contractor's overhead and profit.

G. Revise schedule to list approved Change Orders, with each Application for Payment.

1.05 APPLICATIONS FOR PAYMENT

A. See specification section 01 02 70.

B. Substantiating Data: When Owner's Project Manager requires substantiating information, submit data justifying dollar amounts in question. Include the following with Application for Payment:
   1. Current construction photographs specified in Section 01 38 00.
   2. Partial release of liens from major subcontractors and vendors.
   3. Record documents as specified in Section 01 70 00, for review by Owner which will be returned to Contractor.
   4. Affidavits attesting to on-site stored products.
   5. Affidavits attesting to off-site stored products.
   6. Construction progress schedules, revised and current as specified in Section 01 31 00.

1.06 CHANGE PROCEDURES

A. See specification section 01 02 80.

B. Contractor may propose changes by submitting a request for change to Owner's Project Manager, describing proposed change and its full effect on the Work. Include a statement describing reason for the change, and effect on Contract Sum/Price and Contract Time with full documentation and a statement describing effect on Work by separate or other Contractors. Document requested substitutions in accordance with Section 01 60 00.

C. Change Order Forms: as used by the Owner's Project Manager.

D. Execution of Change Orders: Owner's Project Manager will issue Change Orders for signatures of parties as provided in Conditions of the Contract.

E. Correlation Of Contractor Submittals:
   1. Promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as separate line item and adjust Contract Sum/Price.
   2. Promptly revise progress schedules to reflect change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.
   3. Promptly enter changes in Project Record Documents.

1.07 DEFECT ASSESSMENT

A. Replace the Work, or portions of the Work, not conforming to specified requirements.

B. If, in the opinion of the Owner's Project Manager, it is not practical to remove and replace the Work, the Architect will direct appropriate remedy or lower payment

C. The defective Work may remain, but Contract sum/price will be adjusted to new lower Contract sum/price at discretion of Owner's Project Manager.

D. Defective Work may be partially repaired to instructions of Owner's Project Manager, and Contract sum/price will be adjusted to new lower Contract sum/price at discretion of Architect.

E. Individual specification sections may modify these options or may identify specific formula or percentage sum/price reduction.

F. Authority of Owner's Project Manager to assess defects and identify payment adjustments, is final.

G. Non-Payment For Rejected Products: Payment will not be made for rejected products for any of the following:
   1. Products wasted or disposed of in a manner that is not acceptable.
   2. Products determined as unacceptable before or after placement.
   3. Products not completely unloaded from transporting vehicle.

4. Products placed beyond lines and levels of required Work.
5. Products remaining on hand after completion of the Work.
6. Loading, hauling, and disposing of rejected products.

1.08 UNIT PRICES (IF ANY)

A. Authority: Measurement methods are delineated in individual specification sections.

B. Measurement methods delineated in individual specification sections complement criteria of this section. In event of conflict, requirements of individual specification section govern.

C. Take measurements and compute quantities. Owner's Project Manager will verify measurements and quantities.

D. Unit Quantities: Quantities and measurements indicated in Proposal Form (IF ANY) are for contract purposes only. Quantities and measurements supplied or placed in the Work shall determine payment. Actual quantities provided shall determine payment.
   1. When actual Work requires more or fewer quantities than those quantities indicated, provide required quantities at unit sum/prices contracted.
   2. When actual Work requires 10 percent or greater change in quantity than those quantities indicated, Owner or Contractor may claim for Contract Price adjustment.

E. Payment Includes: Full compensation for required labor, products, tools, equipment, plant and facilities, transportation, services and incidentals; erection, application or installation of item of the Work; overhead and profit.

F. Final payment for Work governed by unit prices will be made on basis of actual measurements and quantities accepted by Owner's Project Manager multiplied by unit sum/price for Work incorporated in or made necessary by the Work.

PART 2 PRODUCTS

2.01 NOT USED.

PART 3 EXECUTION

3.01 NOT USED.

END OF SECTION

SECTION 01 21 00
ALLOWANCES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Inspecting and testing allowances.

1.02 INSPECTING AND TESTING ALLOWANCES

A. Costs Included in Inspecting and Testing Allowances: Cost of engaging an inspecting or testing agency; execution of inspecting and tests; and reporting results.

B. Costs Not Included in the Inspecting and Testing Allowances:
   1. Costs of incidental labor and facilities required to assist inspecting or testing agency.
   2. Costs of testing services used by Contractor separate from Contract Document requirements.
   3. Costs of retesting upon failure of previous tests as determined by Architect.

C. Payment Procedures:
   1. Submit one copy of the inspecting or testing firm's invoice with next application for payment.
   2. Pay invoice on approval by Owner or Owner's Representative

D. Differences in cost will be adjusted by Change Order.

1.03 ALLOWANCES SCHEDULE

A. Branding / Way Finding Allowance: For additional work in the first floor, second floor and third floor main lobby's include a sum of $100,000 for use upon the Owner's Instructions.

B. Inspecting and Testing Allowance: Include the sum of $20,000 for payment of inspecting services specified in Section 01 40 00 - Quality Requirements.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 22 00

UNIT PRICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. List of unit prices, for use in preparing Proposals.

B. Measurement and payment criteria applicable to Work performed under a unit price payment method.

C. Defect assessment and non-payment for rejected work.

1.02 COSTS INCLUDED

A. Unit Prices included on the Proposal Form shall include full compensation for all required labor, products, tools, equipment, plant, transportation, services and incidentals; erection, application or installation of an item of the Work; overhead and profit.

1.03 UNIT QUANTITIES SPECIFIED

A. Quantities indicated in the Proposal are for proposal and contract purposes only. Quantities and measurements of actual Work will determine the payment amount.

1.04 MEASUREMENT OF QUANTITIES

A. Measurement methods delineated in the individual specification sections complement the criteria of this section. In the event of conflict, the requirements of the individual specification section govern.

B. Take all measurements and compute quantities. Measurements and quantities will be verified by Owner.

C. Assist by providing necessary equipment, workers, and survey personnel as required.

D. Measurement by Volume: Measured by cubic dimension using mean length, width and height or thickness.

1.05 PAYMENT

A. Payment for Work governed by unit prices will be made on the basis of the actual measurements and quantities of Work that is incorporated in or made necessary by the Work and accepted by the Architect, multiplied by the unit price.

B. Payment will not be made for any of the following:
   1. Products wasted or disposed of in a manner that is not acceptable.
   2. Products determined as unacceptable before or after placement.
   3. Products not completely unloaded from the transporting vehicle.
   4. Products placed beyond the lines and levels of the required Work.
   5. Products remaining on hand after completion of the Work.
   6. Loading, hauling, and disposing of rejected Products.

1.06 DEFECT ASSESSMENT

A. Replace Work, or portions of the Work, not conforming to specified requirements.

B. If, in the opinion of Owner, it is not practical to remove and replace the Work, Owner will direct one of the following remedies:
   1. The defective Work may remain, but the unit price will be adjusted to a new unit price at the discretion of Owner.
   2. The defective Work will be partially repaired to the instructions of the Owner, and the unit price will be adjusted to a new unit price at the discretion of Owner.

C. The individual specification sections may modify these options or may identify a specific formula or percentage price reduction.

D. The authority of Owner to assess the defect and identify payment adjustment is final.

1.07 SCHEDULE OF UNIT PRICES

A. Item: Lean Concrete (Controlled Density Fill); Section 03 00 00.

B. Item: Diagonal Bracing; Section 05 50 00.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 23 00
ALTERNATES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Description of Alternates.

1.02 RELATED REQUIREMENTS

A. Document 00 43 23 - Alternates Form: List of Alternates as supplement to Proposal Form.

1.03 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.

B. Coordinate related work and modify surrounding work to integrate the Work of each Alternate.

1.04 SCHEDULE OF ALTERNATES

A. Alternate No. 1 - Pressure Wash Exterior Concrete Surfaces:
   1. Alternate Item: Section 03 01 00 Maintenance of Concrete and Drawing sheet numbers including A201, A202, A203.

B. Alternate No. 2 - Replace all round handled latch / locksets with levered handled latch / locksets:
   1. Alternate Item: Section 08 71 00 Door Hardware including Door Hardware Schedule.

C. Alternate No. 3 - Provide luxury vinyl tile in suite lobby spaces:
   1. Alternate Item: Section 09 65 00 Resilient Flooring, Room Finish Schedule, and Drawing sheet numbers including A115, A125, A135.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 30 00

ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Submittal procedures.

B. Construction progress schedules.

C. Proposed products list.

D. Shop drawings.

E. Product data.

F. Samples.

G. Manufacturers' instructions.

H. Manufacturers' certificates.

1.02 RELATED SECTIONS

A. Marion County General Conditions: Contract Closeout

B. Section 01 40 00 - Quality Requirements: Manufacturers' field services and reports.

C. Section 01 70 00 - Execution and Closeout Requirements: Contract warranty and manufacturer's certificates closeout submittals.

1.03 SUBMITTAL PROCEDURES

A. Transmit each submittal with Owner’s Project Manager accepted form.

B. Electronic submission of submittals to Architect and Owner's Project Manager via e-mail is preferred. In the case of samples, or submittals for which an electronic copy is not obtainable, submit minimum quantity of copies of submittals in accordance with Marion County Public Improvement Agreement Form and Marion County General Conditions for Public Improvement Contracts PLUS AS MANY ADDITIONAL COPIES WHICH WILL BE RETURNED TO THE CONTRACTOR; minimum three copies of submittals will be retained by the Owner’s Project Manager.

C. Identify Project, Contractor, Subcontractor or supplier; pertinent Drawing sheet and detail number(s), and specification Section number, as appropriate.

D. Apply Contractor's stamp, signed or initialed certifying that review, verification of Products required, field dimensions, adjacent construction Work, and coordination of information, is in accordance with the requirements of the Work and Contract Documents.

E. Identify variations from Contract Documents and Product or system limitations which may be detrimental to successful performance of the completed Work.

F. Provide space for Contractor and Owner’s Project Manager review stamps.

G. Revise and resubmit submittals as required, identify all changes made since previous submittal.

H. Distribute copies of reviewed submittals to concerned parties. Instruct parties to promptly report any inability to comply with provisions.

1.04 CONSTRUCTION PROGRESS SCHEDULES

A. SUBMIT INITIAL PROGRESS SCHEDULE IN ACCORDANCE WITH MARION COUNTY PUBLIC IMPROVEMENT AGREEMENT FORM AND MARION COUNTY GENERAL CONDITIONS FOR PUBLIC IMPROVEMENT CONTRACT IN TRIPLICATE WITHIN FIFTEEN (15) CALENDAR DAYS AFTER DATE OF NOTICE TO PROCEED FOR OWNER’S PROJECT MANAGER REVIEW.

B. Revise and resubmit as required or requested.

C. Submit Progress Schedule in format specified in Section 01 31 00 and/or as indicated below.

D. Show complete sequence of construction by activity, identifying Work of separate stages and other logically grouped activities.

E. Indicate estimated percentage of completion for each item of Work at each submission.

F. Indicate submittal dates required for shop drawings, product data, samples, and product delivery dates.

1.05 PROPOSED PRODUCTS LIST

A. WITHIN REASONABLE PROMPTNESS, AFTER DATE OF NOTICE TO PROCEED, PER MARION COUNTY PUBLIC IMPROVEMENT AGREEMENT FORM AND MARION COUNTY GENERAL CONDITIONS FOR PUBLIC IMPROVEMENT CONTRACT, SUBMIT COMPLETE LIST OF MAJOR PRODUCTS PROPOSED FOR USE, WITH NAME OF MANUFACTURER, TRADE NAME, AND MODEL NUMBER OF EACH PRODUCT.

B. For products specified only by reference standards, give manufacturer, trade name, model or catalog designation, and reference standards.

1.06 SHOP DRAWINGS

A. Submit the number of opaque reproductions which Contractor requires in accordance with Marion County Public Improvement Agreement and Marion County General Conditions for Public Improvement Contract, PLUS THREE COPIES WHICH WILL BE RETAINED BY THE OWNER'S PROJECT MANAGER.

B. After review distribute in accordance with Article on Procedures above and for Record Documents described in Section 01 70 00 - Execution and Closeout Requirements.

1.07 PRODUCT DATA

A. Submit the number of copies which the Contractor requires, PLUS THREE COPIES WHICH WILL BE RETAINED BY THE OWNER'S PROJECT MANAGER.

B. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information unique to this Project.

C. After review, distribute in accordance with Article on Procedures above and provide copies for Record Documents described in Section 01 70 00 - Execution and Closeout Requirements.

1.08 SAMPLES

A. Submit samples to illustrate functional and aesthetic characteristics of the Product, with integral parts and attachment devices. Coordinate sample submittals for interfacing Work.

B. Submit samples of finishes from the full range of manufacturers' standard colors, textures, and patterns for Owner's Project Manager selection.

C. Include identification on each sample, with full Project information.

D. Submit the number of samples specified in individual specification Sections; TWO of which will be retained by Owner's Project Manager. If number of samples are not indicated in individual specification Sections submit minimum of THREE; two of which will be retained by Owner's Project Manager.

E. Reviewed samples which may be used in the Work are indicated in individual specification Sections.

1.09 MANUFACTURER'S INSTRUCTIONS

A. When specified in individual specification Sections, submit manufacturers' printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, in quantities specified for Product Data.

B. Identify conflicts between manufacturers' instructions and Contract Documents.

1.10 MANUFACTURER'S CERTIFICATES

A. When specified in individual specification Sections, submit manufacturers' certificate to Owner's Project Manager for review, in quantities specified for Product Data.

B. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference date, affidavits, and certifications as appropriate.

C. Certificates may be recent or previous test results on material or Product, but must be acceptable to Owner's Project Manager.

PART 2 PRODUCTS

2.01 NOT USED

PART 3 EXECUTION

3.01 NOT USED

END OF SECTION

SECTION 01 31 00

PROGRESS SCHEDULES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Format.

B. Content.

C. Revisions to schedules.

D. Submittals.

1.02 RELATED SECTIONS

A. Marion County General Conditions: Administration of the Contract and Schedule of Work.

B. Section 01 10 00 - Summary: Owner occupancy.

C. Section 01 04 10 - Project Coordination: Schedules/sequencing/phased Work.

D. Section 01 30 00 - Administrative Requirements: Construction Progress Schedules.

E. Section 01 30 00 - Administrative Requirements: Shop drawings.

1.03 FORMAT

A. Prepare schedules as a horizontal bar chart with separate bar for each major portion of Work or operation, identifying first work day of each week.

B. Sequence of Listings: The chronological order of the start of each item of Work.

C. Scale and Spacing: To provide space for notations and revisions.

D. Sheet Size: Minimum 11 x 17 inches.

E. Quantity: Three (3)

1.04 CONTENT

A. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.

B. Identify each item by specification section number.

C. Identify Work of separate stages and other logically grouped activities.

D. Provide sub-schedules to define critical portions of the entire schedule.

E. Show accumulated percentage of completion of each item, and total percentage of Work completed, as of the first day of each month.

F. Provide separate schedule of submittal dates for shop drawings, product data, and samples, including Owner furnished products, and dates reviewed submittals will be required from the Owner's Project Manager. Indicate decision dates for selection of finishes.

G. Indicate delivery dates for Owner furnished products, if any.

1.05 REVISIONS TO SCHEDULES

A. Indicate progress of each activity to date of submittal, and projected completion date of each activity.

B. Identify activities modified since previous submittal, major changes in scope, and other identifiable changes.

C. Provide narrative report to define problem areas, anticipated delays, and impact on Schedule. Report corrective action taken, or proposed, and its effect.

1.06 SUBMITTALS

A. Submit initial schedule(s) in accordance with Marion County Public Improvement Agreement and Marion County General Conditions for Public Improvement Contract within fifteen (15)

calendar days after date of Notice to Proceed. After review, resubmit required revised data within seven calendar days.

B. Submit revised Progress Schedules at each job site meeting with the Owner's Project Manager that occur at the start of each calendar month.

C. Submit three opaque reproductions of the Progress Schedule to the Owner's Project Manager.

1.07 DISTRIBUTION

A. Distribute copies of reviewed schedules to Project site file, Subcontractors, suppliers, and other concerned parties.

B. Instruct recipients to promptly report, in writing, problems anticipated by projections indicated in schedules. Submit copy of recipients response to the Owner's Project Manager.

PART 2 PRODUCTS

2.01 NOT USED.

PART 3 EXECUTION

3.01 NOT USED.

END OF SECTION

SECTION 01 38 00

CONSTRUCTION PHOTOGRAPHS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Photography.

B. Digital Files.

C. Technique.

D. Submittals.

1.02 RELATED SECTIONS

A. General Conditions and applicable Supplementary Conditions: Dates for applications for payment.

B. Section 01 10 00 - Summary: Stages of the Work.

C. Section 01 70 00 - Execution and Closeout Requirements: Project record documents.

1.03 PHOTOGRAPHY

A. Provide photographs of site and construction throughout progress of Work produced by a photographer acceptable to the Owner's Project Manager.

B. Take photographs during the course of construction to record progress and uncovered conditions to document for the Owner's Project Manager as follows:
   1. Demolition.
   2. Existing utilities uncovered during course of the Work.
   3. Damaged existing construction and damage caused during new work.
   4. Bench marks, reference points, and construction layout.
   5. New construction during the course of the Work.
   6. Final completion.

C. Take photographs as evidence of existing project conditions. Report any existing conditions of consequence to the Owner's Project Manager prior to undertaking the Work.

D. Schedule photographs of site and construction on a minimum weekly basis.

1.04 DIGITAL FILES

A. Original full color, high resolution, .JPG or .TIF format files.

B. Color photocopies are not acceptable.

C. Identify date of photo (year-month-day format xxxx-xx-xx), abbreviated name of project, photographer's numbered identification of exposure, and subject (if applicable) in file name.

1.05 TECHNIQUE

A. Provide factual presentation.

B. Provide correct exposure and focus, high resolution and sharpness, maximum depth of field, and minimum distortion.

1.06 VIEWS

A. Consult with Architect and Owner's Project Manager for instructions on views required.

1.07 SUBMITTALS

A. Deliver digital files within three days after exposure via e-mail to Architect and Owner's Project Manager with transmittal letter specified under Section 01 30 00.

B. Name all files with date and subject.

PART 2 PRODUCTS

2.01 NOT USED

PART 3 EXECUTION

3.01 NOT USED

END OF SECTION

SECTION 01 40 00

QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Quality assurance and control of installation.

B. References.

C. Field samples.

D. Manufacturers' field services and reports.

E. Correlation and Intent of Contract Documents.

F. Code requirements.

G. Existing conditions and dimensions.

H. Guarantee of Work.

1.02 RELATED SECTIONS

A. Section 01 10 00 - Summary.

B. Section 01 09 00 - Reference Standards.

C. Section 01 30 00 - Administrative Requirements: Submission of Manufacturers' Instructions and Certificates.

D. Section 01 60 00 - Product Requirements: Requirements for material and product quality.

1.03 QUALITY ASSURANCE/CONTROL OF INSTALLATION

A. Unless otherwise specified, perform the Work using workers skilled in the particular type of work involved.

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

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

D. Should manufacturers' instructions conflict with Contract Documents, request clarification from Owner’s Project Manager before proceeding.

E. Comply with specified standards as a minimum quality for the Work except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

F. Perform Work by persons qualified to produce workmanship of specified quality.

G. Should the Owner’s Project Manager, in writing, deem anyone on the Work incompetent or unfit for the assigned duties, dismiss the worker immediately or re-assign the worker to a different task requiring a lesser degree of competence.

H. Work shall be first class in every respect and all Work performed shall be according to the best trade practices.

I. The Contractor shall maintain effective supervision on the project at all times Work is being performed. The Superintendent shall be the same person throughout the project AND SHALL ATTEND THE PRECONSTRUCTION CONFERENCE.

J. Secure Products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion or disfigurement.

K. Unless specified and/or noted otherwise materials and products indicated/specified shall be new; re-use of existing materials and products must be specifically allowed by notation in the Contract Documents. Used materials and products are not allowed unless specified and/or noted otherwise.

1.04 REFERENCES

A. Conform to reference standard edition that is current on date of Contract Documents

B. Obtain copies of standards when required by Contract Documents.

C. Should specified reference standards conflict with Contract Documents, request clarification from Owner's Project Manager before proceeding.

D. The contractual relationship of the parties to the Contract shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.05 FIELD SAMPLES

A. Install field samples at the site as required by individual specifications Sections for review.

B. Acceptable samples represent a quality level for the Work.

C. Where field sample is specified in individual Sections to be removed, clear area after field sample has been accepted by Owner's Project Manager.

1.06 MANUFACTURERS' FIELD SERVICES AND REPORTS

A. When specified in individual specification Sections, require material or Product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust, and balance of equipment as applicable, and to initiate instructions when necessary.

B. Individuals to report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

C. Submit report in duplicate within thirty (30) days of observation to the Owner's Project Manager for review.

1.07 CORRELATION AND INTENT OF CONTRACT DOCUMENTS

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

B. Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade. THE ARCHITECT WILL NOT ADVISE THE CONTRACTOR AS TO SUBCONTRACTOR WORK RESPONSIBILITY.

C. The General Contractor and all Sub-Contractors shall examine all portions of the Contract Documents as they form the Contract for Construction. Neither the Owner or the Architect will be responsible for use by the Contractor or Sub-Contractors of partial or incomplete sets of documents.

1.08 CODE REQUIREMENTS

A. Construction of this project shall be under jurisdiction and codes of the City of Salem, Marion County, State of Oregon Department of Commerce, the Oregon State Fire Marshal's Rules and Regulations, and the requirements of the National Electrical Code, International Building Code, and International Fire Code. Contractor shall comply with requirements of latest edition of each listed above.

B. Comply with Oregon Department of Environmental Quality rules, regulations, and requirements for handling and disposal of hazardous materials.

1.09 EXISTING CONDITIONS AND DIMENSIONS

A. Field verify existing conditions prior to proposal opening. Request clarification from the Owner's Project Manager for conditions found that are in conflict with information shown on the drawings or specified prior to proposal opening.

B. Field verify existing dimensions/measurements prior to proposal opening. Do not scale measurements or dimensions from the Drawings. Proposal errors resulting from scaled measurements & dimensions shall be solely the responsibility of the Proposer.

C. Field verify dimensions of new openings, new construction, and new equipment/devices prior to ordering any material components subject to field dimensions. Successful Proposer is responsible for dimensions which shall be confirmed and correlated at the project site for compatibility with project components.

D. Project components ordered or obtained for incorporation with the work that are not compatible with verifiable dimensions shall be solely the responsibility of the successful Proposer.

1.10 INFEASIBLE WORK

A. If work is required in a manner to make it impossible to produce first class work or should discrepancies appear among Contract Documents, make a written request for interpretation to Owner's Project Manager before proceeding with Work. If Contractor fails to make such written request, no excuse will there-after be entertained for failure to carry out work in satisfactory manner.

B. If work is shown in the Contract Documents that is not possible to complete, or deletion/addition of work in one area makes it impossible or infeasible to complete work in another area, make a written request for interpretation to Owner's Project Manager before proceeding with further work. If Contractor fails to make such written request, no excuse will thereafter be entertained for failure to carry out work in satisfactory manner.

C. Means and methods of construction are solely the responsibility of the Contractor. Proposal means and methods that are deemed infeasible by site conditions, other than concealed conditions, shall be the sole responsibility of the Contractor. The Owner shall not compensate the Contractor for changes to means and methods when determined infeasible by site conditions, other than concealed conditions.

1.11 GUARANTEE OF WORK

A. Before final payment is made to the General Contractor, he/she shall furnish a written guarantee to repair or replace any defects caused by faulty workmanship or materials, without additional cost to the Owner. The guarantee shall cover a period of one year from the date of acceptance of the project by the Owner, unless a longer period of coverage is required by the specifications or special provisions.

PART 2 PRODUCTS

2.01 NOT USED

PART 3 EXECUTION

3.01 NOT USED

END OF SECTION

SECTION 01 50 00
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Temporary utilities.

B. Temporary sanitary facilities.

C. Temporary Controls: Barriers, enclosures, and fencing.

D. Security requirements.

E. Waste removal facilities and services.

1.02 RELATED REQUIREMENTS

A. Section 01 51 00 - Temporary Utilities.

1.03 TEMPORARY UTILITIES - SEE SECTION 01 51 00

1.04 TEMPORARY SANITARY FACILITIES

A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.

B. Maintain daily in clean and sanitary condition.

1.05 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public and to protect existing facilities and adjacent properties from damage from construction operations and demolition.

B. Provide barricades and covered walkways required by governing authorities for public rights-of-way and for public access to existing building.

C. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.06 FENCING

A. Provide 6 foot high fence around construction site; equip with vehicular and pedestrian gates with locks.

1.07 EXTERIOR ENCLOSURES

A. Provide temporary weather tight closure of exterior openings to accommodate acceptable working conditions and protection for Products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.

1.08 INTERIOR ENCLOSURES

A. Provide temporary partitions and ceilings as indicated to separate work areas from Owner-occupied areas, to prevent penetration of dust and moisture into Owner-occupied areas, and to prevent damage to existing materials and equipment.

B. Construction: Framing and reinforced polyethylene sheet materials with closed joints and sealed edges at intersections with existing surfaces:

1.09 WASTE REMOVAL

A. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.

B. Provide containers with lids. Remove trash from site periodically.

C. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.

D. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 57 21
INDOOR AIR QUALITY CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Construction procedures to promote adequate indoor air quality after construction.

1.02 PROJECT GOALS

A. Dust and Airborne Particulates: Prevent deposition of dust and other particulates in HVAC ducts and equipment.
   1. Cleaning of ductwork is not contemplated under this Contract.
   2. Contractor shall bear the cost of cleaning required due to failure to protect ducts and equipment from construction dust.

B. Airborne Contaminants: Procedures and products have been specified to minimize indoor air pollutants.
   1. Furnish products meeting the specifications.
   2. Avoid construction practices that could result in contamination of installed products leading to indoor air pollution.

1.03 RELATED REQUIREMENTS

A. Section 23 40 00 - HVAC Air Cleaning Devices: HVAC filters.

1.04 REFERENCE STANDARDS

A. SMACNA (OCC) - IAQ Guideline for Occupied Buildings Under Construction; 2007.

1.05 DEFINITIONS

A. Adsorptive Materials: Gypsum board, acoustical ceiling tile and panels, carpet and carpet tile, fabrics, fibrous insulation, and other similar products.

B. Contaminants: Gases, vapors, regulated pollutants, airborne mold and mildew, and the like, as specified.

C. Particulates: Dust, dirt, and other airborne solid matter.

D. Wet Work: Concrete, plaster, coatings, and other products that emit water vapor or volatile organic compounds during installation, drying, or curing.

1.06 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Indoor Air Quality Management Plan: Describe in detail measures to be taken to promote adequate indoor air quality upon completion; use SMACNA (OCC) as a guide.
   1. Submit not less than 60 days before enclosure of building.
   2. Identify potential sources of odor and dust.
   3. Identify construction activities likely to produce odor or dust.
   4. Identify areas of project potentially affected, especially occupied areas.
   5. Evaluate potential problems by severity and describe methods of control.
   6. Describe construction ventilation to be provided, including type and duration of ventilation, use of permanent HVAC systems, types of filters and schedule for replacement of filters.
   7. Describe cleaning and dust control procedures.

C. Interior Finishes Installation Schedule: Identify each interior finish that either generates odors, moisture, or vapors or is susceptible to adsorption of odors and vapors, and indicate air handling zone, sequence of application, and curing times.

D. Duct and Terminal Unit Inspection Report.

PART 3 EXECUTION

2.01 CONSTRUCTION PROCEDURES

A. Prevent the absorption of moisture and humidity by adsorptive materials by:

1. Sequencing the delivery of such materials so that they are not present in the building until wet work is completed and dry.
2. Delivery and storage of such materials in fully sealed moisture-impermeable packaging.
3. Provide sufficient ventilation for drying within reasonable time frame.

B. Begin construction ventilation when building is substantially enclosed.

C. HVAC equipment and ductwork may NOT be used for ventilation during construction:
1. Provide temporary ventilation equivalent to 1.5 air changes per hour, minimum.
2. Exhaust directly to outside.
3. Seal HVAC air inlets and outlets immediately after duct installation.

D. Do not store construction materials or waste in mechanical or electrical rooms.

E. Prior to use of return air ductwork without intake filters clean up and remove dust and debris generated by construction activities.
1. Inspect duct intakes, return air grilles, and terminal units for dust.
2. Clean plenum spaces, including top sides of lay-in ceilings, outsides of ducts, tops of pipes and conduit.
3. Clean tops of doors and frames.
4. Clean mechanical and electrical rooms, including tops of pipes, ducts, and conduit, equipment, and supports.
5. Clean return plenums of air handling units.
6. Remove intake filters last, after cleaning is complete.

F. Do not perform dusty or dirty work after starting use of return air ducts without intake filters.

G. Use other relevant recommendations of SMACNA (OCC) for avoiding unnecessary contamination due to construction procedures.

END OF SECTION

SECTION 01 60 00

PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Products.

B. Transportation and handling.

C. Storage and protection.

D. Product options.

E. Substitutions.

1.02 RELATED SECTIONS

A. Marion County Request for Proposal, Section C.1.1 - Points of Contact.

B. Marion County Request for Proposal, Section C.1.8 - Brand Name Usage.

C. Marion County Request for Proposal, Section C.2 - Request for Brand Name / Product Substitution.

D. Marion County Request for Proposal, Section C.4.4 - Contract Forms.

E. Marion County General Conditions: Administration of the Contract and Job Site Conditions.

F. Section 01 1000 - Summary: Summary of Work.

G. Section 01 4000 - Quality Requirements: Product quality monitoring.

1.03 PRODUCTS

A. Products: Means new material, machinery, components, equipment, fixtures, and systems forming the Work. Does not include machinery and equipment used for preparation, fabrication, conveying and erection of the Work. Products may also include existing materials or components required for reuse.

B. Do not re-use materials and equipment removed from existing premises, except as specifically permitted by the Contract Documents.

C. Provide interchangeable components of the same manufacturer, for similar components.

D. All products, as defined above, shall be new, unless noted otherwise in the Contract Documents.

1.04 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Any product meeting those standards or description.

B. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

1.05 SUBSTITUTIONS

A. Requests for substitution of products in place those specified shall be in accordance with Instructions to Proposers in Request for Proposal, and as specified herein.

B. Provide same guarantee for accepted substitutions as for products specified.

C. Coordinate installation of accepted substitutions into the Work, making such changes as may be required for the Work to be complete in all respects.

D. Substitution Requirements During the Proposal Period -Submit ONE (1) copy of the following information with each request to the Architect/Engineer:
   1. Substitution Request Form: See Section 01 64 10.
   2. Itemized comparison of proposed substitution with product or method specified.
   3. Complete data on each material and system for this project only, substantiating compliance of proposed substitution with the Contract Documents.

4. Complete evidence, including test numbers and supporting reports, indicating compliance with referenced standards.
5. A statement from the materials manufacturer stating warrantee requirements specified are acceptable and such a warranty shall be issued upon successful completion of the project.
6. A set of details for this project clearly indicating specific deviations proposed for the substitution. Copies of the Drawings and Details for this Project shall be used for this purpose. Any and all deviations shall be indicated.
7. Copies of related specifications sections within the Project Manual clearly marked to indicate all deviations in materials, products, and methods specified. Any and all deviations shall be indicated.
8. Samples of all materials and products including accessories, anchors, and similar items.

E. ALL SUBSTITUTION REQUESTS SHALL BE RECEIVED IN THE ARCHITECT'S OFFICE NO LESS THAN SEVEN (7) CALENDAR DAYS BEFORE THE PROPOSAL OPENING DATE. REQUESTS RECEIVED AFTER THIS DATE WILL NOT BE CONSIDERED.

F. SUBMIT ELECTRONIC COPIES BY E-MAIL TO ARCHITECT, WITH A COPY TO OWNER'S PROJECT MANAGER.

1.06 SUBSTITUTIONS FOR VALUE ENGINEERING

A. Substitutions may be considered between when the proposal is accepted and when the contract is awarded if value engineering is required to bring the scope of work within the Owner's budget. SUBSTITUTIONS AFTER THE PROPOSAL PERIOD WILL NOT BE CONSIDERED DUE TO FAILURE OF THE SUBSTITUTION PROPOSER TO COMPLY WITH SUBSTITUTION REQUEST REQUIREMENTS DURING THE PROPOSAL PERIOD.

1.07 SUBSTITUTIONS AFTER THE AWARD OF CONTRACT

A. Substitutions may be considered after the proposal period when a product becomes unavailable through no fault of the Contractor or other unforseen circumstances. SUBSTITUTIONS AFTER THE PROPOSAL PERIOD WILL NOT BE CONSIDERED DUE TO FAILURE OF THE SUBSTITUTION PROPOSER TO COMPLY WITH SUBSTITUTION REQUEST REQUIREMENTS DURING THE PROPOSAL PERIOD.

B. Within a period of thirty (30) days after date of the Contract, the Owner may, at its option, consider formal written requests for substitution of products in place of those specified, when submitted in accordance with the requirements stipulated herein. To receive consideration, one or more of the following conditions must be documented in any such request:
1. The substitution is required for compliance with final interpretation of code requirements or insurance regulations.
2. The substitution is required due to unavailability of a specified product, through no fault of the Contractor.
3. The substitution is required because subsequent information disclosed the inability of the specified product to perform properly or to fit in the designated space.
4. The substitution is required because it has become clearly evident, in the judgement of the Owner, that a substitute would be substantially in the best interest of the Owner in terms of cost, time, or other considerations.

C. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.

D. Substitutions may be considered by the Owner at any time when determined that the substitution is required because it has become clearly evident, in the judgement of the Owner, that a substitute would be substantially in the best interest of the Owner in terms of cost, time, or other considerations.

PART 2 PRODUCTS

2.01 NOT USED

PART 3 EXECUTION

3.01 TRANSPORTATION AND HANDLING

A. Transport and handle products in accordance with manufacturer's instructions.

B. Promptly inspect shipments to assure that products comply with requirements, quantities are correct, and products are undamaged.

C. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.

3.02 STORAGE AND PROTECTION

A. Store and protect products in accordance with manufacturer's instructions, with seals and labels intact and legible. Store sensitive products in weathertight, climate controlled enclosures.

B. For exterior storage of products, place on sloped supports, above ground.

C. Provide off-site storage and protection when site does not permit on-site storage or protection.

D. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to avoid condensation.

E. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

F. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

G. Arrange storage of products to permit access for inspection. Periodically inspect to assure products are undamaged and are maintained under specified conditions.

H. Make arrangements and coordinate with Owner's Representative all on-site storage activities. Security for on-site stored materials is the responsibility of the Contractor.

END OF SECTION

SECTION 01 6410

SUBSTITUTION REQUEST FORM

TO: SOLARC Engineering and Energy + Architectural Consulting
Attn: Tanesha Hyde: tanesha@solarc-ae.net
CC: Galen Ohmart: galen@solarc-ae.net
CC: Brandon Crossley: bcrossley@co.marion.or.us

PROJECT: Marion County Health Building HVAC, Glazing, and Lighting Replacement
3180 Center St NE
Salem, OR 97301

SPECIFIED ITEM: _____ _____ _____
Section Paragraph Description

The undersigned requests consideration of the following:

PROPOSED SUBSTITUTION:_____

_____

Attached data includes product descriptions, specifications, drawings, photographs, performance and test data adequate for evaluation of request including identification of applicable data portions.

Attached data also includes description of changes to Contract Documents and proposed substitution requires for proper installation.

The undersigned certifies following items, unless modified by attachments, are correct:

1. Proposed substitution does not affect dimensions shown on drawings.
2. Undersigned pays for changes to building design, including engineering design, detailing, and construction costs caused by proposed substitution.
3. Proposed substitution has no adverse effect on other trades, construction schedule, or specified warranty requirements.
4. Maintenance and service parts available locally or readily obtainable for proposed substitution.

Undersigned further certifies function, appearance, and quality of proposed substitution are equivalent to or superior to specified item.

Submitted by: _____ Signature: _____ Firm: _____ Address:_____ _____ Date: _____ Tel: _____ Fax: _____ Attachments:_____	For use by Architect / Engineer for recommendation: ☐ Approved ☐ Approved as noted ☐ Not Approved ☐ Received too late By: _____ Date: _____ Comments: _____ _____ For use by Marion County Project Manager for final decision: ☐ Approved ☐ Approved as noted ☐ Not Approved ☐ Received too late By: _____ Date: _____ Comments: _____

SECTION 01 65 00
STARTING OF SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Starting systems.

B. Demonstration and instructions.

C. Testing, adjusting, and balancing.

1.02 RELATED SECTIONS

A. Section 01 4000 - Quality Requirements: Manufacturers field reports.

B. Section 01 7000 - Execution and Closeout Requirements: System operation and maintenance data and extra materials.

1.03 STARTING SYSTEMS

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

B. Notify Owner’s Project Manager seven days prior to startup of each item.

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

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

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

F. Execute start-up under supervision of responsible personnel 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 in accordance with Section 01 4000 indicating equipment and/or systems have been properly installed and is/are functioning correctly.

1.04 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate operation and maintenance of Products to Owner's personnel two weeks prior to date of final inspection.

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

C. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owners' personnel in detail to explain all aspects of operation and maintenance.

D. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment.

E. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

1.05 TESTING, ADJUSTING, AND BALANCING

A. Contractor shall employ and pay for services of an independent firm to perform testing, adjusting and balancing.

B. Reports will be submitted by the independent firm to the Owner’s Project Manager indicating observations and results of tests and indicating compliance or non-compliance with specified requirements and with the requirements of the Contract Documents.

PART 2 PRODUCTS

2.01 NOT USED

PART 3 EXECUTION

3.01 SCHEDULE

A. Start up, adjust, balance, and make operable any and all new or existing (existing affected by the work of this project) systems to a function and condition equal to or better than existed prior to start of construction. All existing equipment and apparatus affected by Work of this project shall perform equal to or better than existed prior to commencement of the project. Contractor shall be responsible for determining operational functionality and condition of each system prior to starting work. Systems and equipment shall include, but are not limited to:
   1. Fire suppression system.
   2. Plumbing and domestic water system.
   3. Natural gas system.
   4. Heating system.
   5. Ventilation system.
   6. Cooling system.
   7. Controls.
   8. HVAC control.
   9. Lighting control.
   10. Lighting.
   11. Electrical system.
   12. Voice/data system.
   13. Security system, including cameras.
   14. Fire alarm system.
   15. Irrigation system.
   16. Landscaping.

END OF SECTION

SECTION 01 70 00

EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Closeout procedures.

B. Final cleaning.

C. Adjusting.

D. Project record documents.

E. Operation and maintenance data.

F. Warranties.

G. Spare parts and maintenance materials.

1.02 RELATED SECTIONS

A. Marion County General Conditions: Contract Closeout

B. Section 01 40 00 - Quality Requirements: Guarantees and warranties.

C. Section 01 50 00 - Temporary Facilities and Controls: Progress cleaning.

1.03 CLOSEOUT PROCEDURES

A. Submit WRITTEN CERTIFICATION that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Contract Documents and ready for Owner's Project Manager inspection.

B. Provide submittals to Owner's Project Manager that are required by governing, project funding, or other authorities.

C. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due.

D. Owner will occupy all of the building as specified in Section 01 10 00.

1.04 FINAL REVIEW AND PAYMENT

A. Prior to completion the Contractor shall inspect the Work and make a "punch list" noting all items that are incomplete and/or incorrect.

B. The Contractor shall notify all Subcontractors in writing of incomplete and/or incorrect items. Notify far enough in advance of the Completion Date so Work can be completed on schedule. Said Work shall be immediately corrected.

C. Should conditions prevail which prohibit some elements of the Work from being accomplished, but the work-in-place will perform the primary function (i.e., painting can not be completed due to high moisture content of masonry walls, etc.) the Contractor shall record the reason with this "punch list" item requesting temporary delay in completion from the Owner in writing.

D. Notify the Owner in writing that all items are completed and ready for final review or else that the Work product is fully usable, but some listed deficiencies remain to be completed. Submit all record documents at this time.

E. The Owner will review all documents. When documents include a Contractor's request for delay in completion the Owner will review all Work which is certified as complete to the best knowledge of the Contractor. The Owner will also review the listed incomplete Work and assign a value to such incomplete work.

F. The Contractor shall make the required corrections to the Work expeditiously. Upon Owner occupancy, sufficient retainage monies will be held to pay for incomplete Work, should the Contractor fail to perform. A letter will be addressed to the Contractor informing the Contractor of the project status and the monies available for semi-final payment upon receipt of billing.

G. When Contract closeout procedures are completed and all punch list deficiencies have been corrected, final acceptance by the Owner will be documented. The Contractor will receive

written notice of acceptance of the Work and notification that final payment may be billed and released.

1.05 FINAL CLEANING

A. Execute final cleaning prior to final inspection.

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

C. Clean equipment and fixtures to a sanitary condition.

D. Clean filters of operating equipment.

E. Clean debris from area of Work.

F. Remove all tools, screws, nails, and other hardware from the facility and secure said items so as not to present a safety/security issue.

G. Clean site; sweep existing paved areas where materials have been stored or disposed of.

H. Remove waste and surplus materials, rubbish, and construction facilities from the site.

1.06 ADJUSTING

A. Adjust operating Products and Equipment to ensure smooth and unhindered operation.

1.07 PROJECT RECORD DOCUMENTS

A. Maintain on site, three sets of the following record documents; record actual revisions to the Work:
   1. Contract Drawings.
   2. Specifications.
   3. Addenda.
   4. Change Orders and other Modifications to the Contract.
   5. Reviewed shop drawings, product data, and samples.

B. Store Record Documents separate from documents used for construction.

C. Record information concurrent with construction progress.

D. Specifications: Legibly mark and record at each Product section description of actual Products installed, including the following:
   1. Manufacturer's name and product model and number.
   2. Product substitutions or alternates utilized.
   3. Changes made by Addenda and Modifications.

E. Record Documents and Shop Drawings: Legibly mark each item to record actual construction including:
   1. Measured depths of foundations in relation to finish floor datum.
   2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
   3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
   4. Field changes of dimension and detail.
   5. Details not on original Contract Drawings.
   6. Per the General Conditions (K.2), provide two 3-ring tabbed binders that lists all items, components, systems and etc., sorted by the most current CSI format. In addition, one (1) CD with all closing documents, all as-builts (in AUTOCAD and PDF), and other O&M information that depict the project as constructed and shall reflect each and every change, modification, and deletion made during the construction.

F. Submit documents to Owner, as part of the Operations and Maintenance Data manual.

1.08 OPERATION AND MAINTENANCE DATA

A. Submit quantity of sets in accordance with Marion County General Conditions for Public Improvement Contracts, including project record documents, upon 75% completion of the Work.

Bind 8-1/2 x 11 inch text pages in three-ring (D-ring) binders with durable plastic covers. Include a digital copy of the material, organized in the same manner as the binder(s).

B. Prepare binder covers with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS", title of project, and subject matter of binder when multiple binders are required.

C. Internally subdivide the binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.

D. Contents: Prepare a Table of Contents for each volume, with each Product or system description identified.

E. Part 1: Directory, listing names, addresses, and telephone numbers of Architect/Engineer, Contractor, Subcontractors, and major equipment suppliers.

F. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
   1. Significant design criteria.
   2. List of equipment.
   3. Parts list for each component.
   4. Operating instructions.
   5. Maintenance instructions for equipment & systems.
   6. Maintenance instructions for finishes, including recommended cleaning methods and materials and special precautions identifying detrimental agents.

G. Part 3: Project documents and certificates, including the following:
   1. Shop drawings and product data.
   2. Air and water balance reports.
   3. Certificates.
   4. Photocopies of warranties and bonds.

H. Submit completed volume in accordance with Marion County General Conditions for Public Improvement Contracts, Section K.2, in final form prior to submission of any pay request for more than 75% of the Work. This copy will be reviewed after final inspection with Owner's Project Manager comments as necessary . Revise content of documents as required prior to final submittal.

I. Submit final volumes revised, within ten days after final inspection.

1.09 WARRANTIES

A. Provide duplicate notarized copies. Identify Owner's responsibilities under the terms of the warranties.

B. Execute and assemble documents from Subcontractors, suppliers, and manufacturers.

C. Provide Table of Contents and assemble in three D side ring binder with durable plastic cover.

D. Submit prior to final Application for Payment.

E. All warranties and guaranties shall commence and become effective beginning on the date of Final Acceptance by the Owner.

1.10 SPARE PARTS AND MAINTENANCE MATERIALS

A. Provide products, spare parts, maintenance and extra materials in quantities specified in individual specification Sections.

B. Deliver to Project site and place in location as directed.

PART 2 PRODUCTS

2.01 NOT USED

PART 3 EXECUTION

3.01 NOT USED

END OF SECTION

SECTION 01 79 00

DEMONSTRATION AND TRAINING

PART 1 GENERAL

1.01 SUMMARY

A. Demonstration of products and systems

B. Training of Owner personnel in operation and maintenance is required for:
   1. All renovated and upgraded mechanical and electrical systems and equipment.

C. Training of Owner personnel in care, cleaning, maintenance, and repair is required for:
   1. All renovated and upgraded mechanical and electrical systems and equipment.

1.02 RELATED REQUIREMENTS

A. Marion County General Conditions: Contract Closeout.

B. Section 01 91 13 - General Commissioning Requirements: Additional requirements applicable to demonstration and training.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures. And Section 01 70 00 - Execution and Closeout Requirements for closeout procedures

B. Training Plan: Owner will designate personnel to be trained; tailor training to needs and skill-level of attendees.
   1. Submit transmittal to Owner.
   2. Submit not less than four weeks prior to start of training.
   3. Revise and resubmit until acceptable.
   4. Provide an overall schedule showing all training sessions.
   5. Include at least the following for each training session:
      a. Identification, date, time, and duration.
      b. Description of products and/or systems to be covered.
      c. Intended audience, such as job description.
      d. Objectives of training and suggested methods of ensuring adequate training.
      e. Methods to be used, such as classroom lecture, live demonstrations, hands-on, etc.
      f. Media to be used, such a slides, hand-outs, etc.
      g. Training equipment required, such as projector, projection screen, etc., to be provided by Contractor.

C. Training Manuals: Provide training manual for each attendee; allow for minimum of two attendees per training session.
   1. Include applicable portion of O&M manuals.
   2. Include copies of all hand-outs, slides, overheads, video presentations, etc., that are not included in O&M manuals.
   3. Provide one extra copy of each training manual to be included with operation and maintenance data.

D. Video Recordings: Submit digital video recording of each demonstration and training session for Owner's subsequent use.
   1. Format: DVD Disc.
   2. Label each disc and container with session identification and date.
   3. Provide one disk for each set of O&M Manuals. Place in disk holder in front cover.

1.04 QUALITY ASSURANCE

A. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.
   1. Provide as instructors the most qualified trainer of those contractors and/or installers who actually supplied and installed the systems and equipment.

2. Where a single person is not familiar with all aspects, provide specialists with necessary qualifications.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 DEMONSTRATION - GENERAL

A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by Owner.

B. Demonstration may be combined with Owner personnel training if applicable.

C. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.
   1. Perform demonstrations not less than two weeks prior to Substantial Completion.
   2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

D. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.
   1. Perform demonstrations not less than two weeks prior to Substantial Completion.

3.02 TRAINING - GENERAL

A. Conduct training on-site unless otherwise indicated.

B. Owner will provide classroom and seating at no cost to Contractor.

C. Training schedule will be subject to availability of Owner's personnel to be trained; re-schedule training sessions as required by Owner; once schedule has been approved by Owner failure of Contractor to conduct sessions according to schedule will be cause for Owner to charge Contractor for personnel "show-up" time.

D. Review of Facility Policy on Operation and Maintenance Data: During training discuss:
   1. The location of the O&M manuals and procedures for use and preservation; backup copies.
   2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.
   3. Typical uses of the O&M manuals.

E. Product- and System-Specific Training:
   1. Review the applicable O&M manuals.
   2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.
   3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.
   4. Provide hands-on training on all operational modes possible and preventive maintenance.
   5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.
   6. Discuss common troubleshooting problems and solutions.
   7. Discuss any peculiarities of equipment installation or operation.
   8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.
   9. Review recommended tools and spare parts inventory suggestions of manufacturers.
   10. Review spare parts and tools required to be furnished by Contractor.
   11. Review spare parts suppliers and sources and procurement procedures.

F. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three days.

END OF SECTION

SECTION 01 91 13

GENERAL COMMISSIONING REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

A. Commissioning is intended to achieve the following specific objectives; this section specifies the Contractor's responsibilities for commissioning:
   1. Verify that the work is installed in accordance with the Contract Documents and the manufacturer's recommendations and instructions, and that it receives adequate operational checkout prior to startup: Startup reports and Prefunctional Checklists executed by Contractor are utilized to achieve this.
   2. Verify and document that functional performance is in accordance with the Contract Documents: Functional Tests executed by Contractor and witnessed by the Commissioning Authority are utilized to achieve this.
   3. Verify that operation and maintenance manuals submitted to Owner are complete: Detailed operation and maintenance (O&M) data submittals by Contractor are utilized to achieve this.
   4. Verify that the Owner's operating personnel are adequately trained: Formal training conducted by Contractor is utilized to achieve this.

B. The Commissioning Authority directs and coordinates all commissioning activities; this section describes some but not all of the Commissioning Authority's responsibilities.

1.02 RELATED REQUIREMENTS

A. Section 01 78 00 - Closeout Submittals: Scope and procedures for operation and maintenance manuals and project record documents.

1.03 REFERENCE STANDARDS

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures; except:
   1. Make all submittals specified in this section, and elsewhere where indicated for commissioning purposes, directly to the Commissioning Authority, unless they require review by Architect; in that case, submit to Architect first.
   2. Submit one copy to the Commissioning Authority, not to be returned.
   3. Make commissioning submittals on time schedule specified by Commissioning Authority.
   4. Submittals indicated as "Draft" are intended for the use of the Commissioning Authority in preparation of Prefunctional Checklists or Functional Test requirements; submit in editable electronic format, Microsoft Word 2010 preferred.
   5. As soon as possible after submittals made to Architect are approved, submit copy of approved submittal to the Commissioning Authority.

B. Manufacturers' Instructions: Submit copies of all manufacturer-provided instructions that are shipped with the equipment as soon as the equipment is delivered.

C. Product Data: If submittals to Architect do not include the following, submit copies as soon as possible:
   1. Manufacturer's product data, cut sheets, and shop drawings.
   2. Manufacturer's installation instructions.
   3. Startup, operating, and troubleshooting procedures.
   4. Fan and pump curves.
   5. Factory test reports.
   6. Warranty information, including details of Owner's responsibilities in regard to keeping warranties in force.

D. Startup Plans and Reports.

E. Completed Prefunctional Checklists.

PART 2 PRODUCTS

2.01 TEST EQUIPMENT

A. Provide all standard testing equipment required to perform startup and initial checkout and required Functional Testing; unless otherwise noted such testing equipment will NOT become the property of Owner.

B. Calibration Tolerances: Provide testing equipment of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified. If not otherwise noted, the following minimum requirements apply:
   1. Temperature Sensors and Digital Thermometers: Certified calibration within past year to accuracy of 0.5 degree F and resolution of plus/minus 0.1 degree F.
   2. Pressure Sensors: Accuracy of plus/minus 2.0 percent of the value range being measured (not full range of meter), calibrated within the last year.
   3. Calibration: According to the manufacturer's recommended intervals and when dropped or damaged; affix calibration tags or keep certificates readily available for inspection.

C. Equipment-Specific Tools: Where special testing equipment, tools and instruments are specific to a piece of equipment, are only available from the vendor, and are required in order to accomplish startup or Functional Testing, provide such equipment, tools, and instruments as part of the work at no extra cost to Owner; such equipment, tools, and instruments are to become the property of Owner.

D. Dataloggers: Independent equipment and software for monitoring flows, currents, status, pressures, etc. of equipment.
   1. Dataloggers required to for Functional Tests will be provided by the Commissioning Authority and will not become the property of Owner.

PART 3 EXECUTION

3.01 COMMISSIONING PLAN

A. Commissioning Authority has prepared the Commissioning Plan.
   1. Attend meetings called by the Commissioning Authority for purposes of completing the commissioning plan.
   2. Require attendance and participation of relevant subcontractors, installers, suppliers, and manufacturer representatives.

B. Contractor is responsible for compliance with the Commissioning Plan.

C. Commissioning Plan: The commissioning schedule, procedures, and coordination requirements for all parties in the commissioning process.

D. Commissioning Schedule:
   1. Submit anticipated dates of startup of each item of equipment and system to Commissioning Authority within 60 days after award of Contract.
   2. Re-submit anticipated startup dates monthly, but not less than 4 weeks prior to startup.
   3. Prefunctional Checklists and Functional Tests are to be performed in sequence from components, to subsystems, to systems.
   4. Provide sufficient notice to Commissioning Authority for delivery of relevant Checklists and Functional Test procedures, to avoid delay.

3.02 STARTUP PLANS AND REPORTS

A. Startup Plans: For each item of equipment and system for which the manufacturer provides a startup plan, submit the plan not less than 8 weeks prior to startup.

B. Startup Reports: For each item of equipment and system for which the manufacturer provides a startup checklist (or startup plan or field checkout sheet), document compliance by submitting the completed startup checklist prior to startup, signed and dated by responsible entity.

C. Submit directly to the Commissioning Authority.

3.03 PREFUNCTIONAL CHECKLISTS

A. A Prefunctional Checklist is required to be filled out for each item of equipment or other assembly specified to be commissioned.
   1. No sampling of identical or near-identical items is allowed.
   2. These checklists do not replace manufacturers' recommended startup checklists, regardless of apparent redundancy.
   3. Prefunctional Checklist forms will not be complete until after award of the contract; the following types of information will be gathered via the completed Checklist forms:
      a. Certification by installing contractor that the unit is properly installed, started up, and operating and ready for Functional Testing.
      b. Confirmation of receipt of each shop drawing and commissioning submittal specified, itemized by unit.
      c. Manufacturer, model number, and relevant capacity information; list information "as specified," "as submitted," and "as installed."
      d. Serial number of installed unit.
      e. List of inspections to be conducted to document proper installation prior to startup and Functional Testing; these will be primarily static inspections and procedures; for equipment and systems may include normal manufacturer’s start-up checklist items and minor testing.
      f. Sensor and actuator calibration information.

B. Contractor is responsible for filling out Prefunctional Checklists, after completion of installation and before startup; witnessing by the Commissioning Authority is not required unless otherwise specified.
   1. Each line item without deficiency is to be witnessed, initialed, and dated by the actual witness; checklists are not complete until all line items are initialed and dated complete without deficiencies.
   2. Checklists with incomplete items may be submitted for approval provided the Contractor attests that incomplete items do not preclude the performance of safe and reliable Functional Testing; re-submission of the Checklist is required upon completion of remaining items.
   3. Individual Checklists may contain line items that are the responsibility of more than one installer; Contractor shall assign responsibility to appropriate installers or subcontractors, with identification recorded on the form.
   4. If any Checklist line item is not relevant, record reasons on the form.
   5. Contractor may independently perform startup inspections and/or tests, at his option.
   6. Regardless of these reporting requirements, Contractor is responsible for correct startup and operation.
   7. Submit completed Checklists to Commissioning Authority within two days of completion.

C. Commissioning Authority is responsible for furnishing the Prefunctional Checklists to Contractor.
   1. Initial Drafts: Contractor is responsible for initial draft of Prefunctional Checklist where so indicated in the Contract Documents.
   2. Provide all additional information requested by Commissioning Authority to aid in preparation of checklists, such as shop drawing submittals, manufacturers' startup checklists, and O&M data.
   3. Commissioning Authority may add any relevant items deemed necessary regardless of whether they are explicitly mentioned in the Contract Documents or not.
   4. When asked to review the proposed Checklists, do so in a timely manner.

D. Commissioning Authority Witnessing: Required for:
   1. Each piece of primary equipment, unless sampling of multiple similar units is allowed by the commissioning plan.
   2. A sampling of non-primary equipment, as allowed by the commissioning plan.

E. Deficiencies: Correct deficiencies and re-inspect or re-test, as applicable, at no extra cost to Owner.

1. If difficulty in correction would delay progress, report deficiency to the Commissioning Authority immediately.

3.04 FUNCTIONAL TESTS

A. A Functional Test is required for each item of equipment, system, or other assembly specified to be commissioned, unless sampling of multiple identical or near-identical units is allowed by the final test procedures.

B. Contractor is responsible for execution of required Functional Tests, after completion of Prefunctional Checklist and before closeout.

C. Commissioning Authority is responsible for witnessing and reporting results of Functional Tests, including preparation and completion of forms for that purpose.

D. Contractor is responsible for correction of deficiencies and re-testing at no extra cost to Owner; if a deficiency is not corrected and re-tested immediately, the Commissioning Authority will document the deficiency and the Contractor's stated intentions regarding correction.
   1. Deficiencies are any condition in the installation or function of a component, piece of equipment or system that is not in compliance with the Contract Documents or does not perform properly.
   2. When the deficiency has been corrected, the Contractor completes the form certifying that the item is ready to be re-tested and returns the form to the Commissioning Authority; the Commissioning Authority will reschedule the test and the Contractor shall re-test.
   3. Identical or Near-Identical Items: If 10 percent, or three, whichever is greater, of identical or near-identical items fail to perform due to material or manufacturing defect, all items will be considered defective; provide a proposal for correction within 2 weeks after notification of defect, including provision for testing sample installations prior to replacement of all items.
   4. Contractor shall bear the cost of Owner and Commissioning Authority personnel time witnessing re-testing.
   5. Contractor shall bear the cost of Owner and Commissioning Authority personnel time witnessing re-testing if the test failed due to failure to execute the relevant Prefunctional Checklist correctly; if the test failed for reasons that would not have been identified in the Prefunctional Checklist process, Contractor shall bear the cost of the second and subsequent re-tests.

E. Functional Test Procedures:
   1. Some test procedures are included in the Contract Documents; where Functional Test procedures are not included in the Contract Documents, test procedures will be determined by the Commissioning Authority with input by and coordination with Contractor.
   2. Examples of Functional Testing:
      a. Test the dynamic function and operation of equipment and systems (rather than just components) using manual (direct observation) or monitoring methods under full operation (e.g., the chiller pump is tested interactively with the chiller functions to see if the pump ramps up and down to maintain the differential pressure setpoint).
      b. Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc.
      c. Systems are run through all the HVAC control system’s sequences of operation and components are verified to be responding as the sequence's state.
      d. Traditional air or water test and balancing (TAB) is not Functional Testing; spot checking of TAB by demonstration to the Commissioning Authority is Functional Testing.

F. Deferred Functional Tests: Some tests may need to be performed later, after substantial completion, due to partial occupancy, equipment, seasonal requirements, design or other site conditions; performance of these tests remains the Contractor's responsibility regardless of timing.

3.05 SENSOR AND ACTUATOR CALIBRATION

A. Calibrate all field-installed temperature, relative humidity, carbon monoxide, carbon dioxide, and pressure sensors and gages, and all actuators (dampers and valves) on this piece of equipment shall be calibrated. Sensors installed in the unit at the factory with calibration certification provided need not be field calibrated.

B. Calibrate using the methods described below; alternate methods may be used, if approved by Commissioning Authority and Owner beforehand. See PART 2 for test instrument requirements. Record methods used on the relevant Prefunctional Checklist or other suitable forms, documenting initial, intermediate and final results.

C. All Sensors:
   1. Verify that sensor location is appropriate and away from potential causes of erratic operation.
   2. Verify that sensors with shielded cable are grounded only at one end.
   3. For sensor pairs that are used to determine a temperature or pressure difference, for temperature make sure they are reading within 0.2 degree F of each other, and for pressure, within tolerance equal to 2 percent of the reading, of each other.
   4. Tolerances for critical applications may be tighter.

D. Sensors Without Transmitters - Standard Application:
   1. Make a reading with a calibrated test instrument within 6 inches of the site sensor.
   2. Verify that the sensor reading, via the permanent thermostat, gage or building automation system, is within the tolerances in the table below of the instrument-measured value.
   3. If not, install offset, calibrate or replace sensor.

E. Sensors With Transmitters - Standard Application.
   1. Disconnect sensor.
   2. Connect a signal generator in place of sensor.
   3. Connect ammeter in series between transmitter and building automation system control panel.
   4. Using manufacturer's resistance-temperature data, simulate minimum desired temperature.
   5. Adjust transmitter potentiometer zero until 4 mA is read by the ammeter.
   6. Repeat for the maximum temperature matching 20 mA to the potentiometer span or maximum and verify at the building automation system.
   7. Record all values and recalibrate controller as necessary to conform with specified control ramps, reset schedules, proportional relationship, reset relationship and P/I reaction.
   8. Reconnect sensor.
   9. Make a reading with a calibrated test instrument within 6 inches of the site sensor.
   10. Verify that the sensor reading, via the permanent thermostat, gage or building automation system, is within the tolerances in the table below of the instrument-measured value.
   11. If not, replace sensor and repeat.
   12. For pressure sensors, perform a similar process with a suitable signal generator.

F. Sensor Tolerances for Standard Applications: Plus/minus the following maximums:
   1. Watthour, Voltage, Amperage: 1 percent of design.
   2. Pressure, Air, Water, Gas: 3 percent of design.
   3. Air Temperatures (Outside Air, Space Air, Duct Air): 0.4 degrees F.
   4. Relative Humidity: 4 percent of design.
   5. Barometric Pressure: 0.1 inch of Hg.
   6. Flow Rate, Air: 10 percent of design.
   7. Flow Rate, Water: 4 percent of design.
   8. AHU Wet Bulb and Dew Point: 2.0 degrees F.

G. Critical Applications: For some applications more rigorous calibration techniques may be required for selected sensors. Describe any such methods used on an attached sheet.

H. Valve/Damper Stroke Setup and Check:

1. For all valve/damper actuator positions checked, verify the actual position against the control system readout.
2. Set pump/fan to normal operating mode.
3. Command valve/damper closed; visually verify that valve/damper is closed and adjust output zero signal as required.
4. Command valve/damper to open; verify position is full open and adjust output signal as required.
5. Command valve/damper to a few intermediate positions.
6. If actual valve/damper position does not reasonably correspond, replace actuator or add pilot positioner (for pneumatics).

I. Isolation Valve or System Valve Leak Check: For valves not associated with coils.
1. With full pressure in the system, command valve closed.
2. Use an ultra-sonic flow meter to detect flow or leakage.

3.06 TEST PROCEDURES - GENERAL

A. Provide skilled technicians to execute starting of equipment and to execute the Functional Tests. Ensure that they are available and present during the agreed upon schedules and for sufficient duration to complete the necessary tests, adjustments and problem-solving.

B. Provide all necessary materials and system modifications required to produce the flows, pressures, temperatures, and conditions necessary to execute the test according to the specified conditions. At completion of the test, return all affected equipment and systems to their pre-test condition.

C. Sampling: Where Functional Testing of fewer than the total number of multiple identical or near-identical items is explicitly permitted, perform sampling as follows:
1. Identical Units: Defined as units with same application and sequence of operation; only minor size or capacity difference.
2. Sampling is not allowed for:
   a. Major equipment.
   b. Life-safety-critical equipment.
   c. Prefunctional Checklist execution.
3. XX = the percent of the group of identical equipment to be included in each sample; defined for specific type of equipment.
4. YY = the percent of the sample that if failed will require another sample to be tested; defined for specific type of equipment.
5. Randomly test at least XX percent of each group of identical equipment, but not less than three units. This constitutes the "first sample."
6. If YY percent of the units in the first sample fail, test another XX percent of the remaining identical units.
7. If YY percent of the units in the second sample fail, test all remaining identical units.
8. If frequent failures occur, resulting in more troubleshooting than testing, the Commissioning Authority may stop the testing and require Contractor to perform and document a checkout of the remaining units prior to continuing testing.

D. Manual Testing: Use hand-held instruments, immediate control system readouts, or direct observation to verify performance (contrasted to analyzing monitored data taken over time to make the “observation”).

E. Simulating Conditions: Artificially create the necessary condition for the purpose of testing the response of a system; for example apply hot air to a space sensor using a hair dryer to see the response in a VAV box.

F. Simulating Signals: Disconnect the sensor and use a signal generator to send an amperage, resistance or pressure to the transducer and control system to simulate the sensor value.

G. Over-Writing Values: Change the sensor value known to the control system in the control system to see the response of the system; for example, change the outside air temperature value from 50 degrees F to 75 degrees F to verify economizer operation.

H. Indirect Indicators: Remote indicators of a response or condition, such as a reading from a control system screen reporting a damper to be 100 percent closed, are considered indirect indicators.

I. Monitoring: Record parameters (flow, current, status, pressure, etc.) of equipment operation using dataloggers or the trending capabilities of the relevant control systems; where monitoring of specific points is called for in Functional Test Procedures:
   1. All points that are monitored by the relevant control system shall be trended by Contractor; at the Commissioning Authority's request, Contractor shall trend up to 20 percent more points than specified at no extra charge.
   2. Other points will be monitored by the Commissioning Authority using dataloggers.
   3. At the option of the Commissioning Authority, some control system monitoring may be replaced with datalogger monitoring.
   4. Provide hard copies of monitored data in columnar format with time down left column and at least 5 columns of point values on same page.
   5. Graphical output is desirable and is required for all output if the system can produce it.
   6. Monitoring may be used to augment manual testing.

3.07 OPERATION AND MAINTENANCE MANUALS

A. See Section 01 78 00 - Closeout Submittals for additional requirements.

B. Add design intent documentation furnished by Architect to manuals prior to submission to Owner.

C. Submit manuals related to items that were commissioned to Commissioning Authority for review; make changes recommended by Commissioning Authority.

D. Commissioning Authority will add commissioning records to manuals after submission to Owner.

END OF SECTION

SECTION 02 41 00

DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Building demolition excluding removal of hazardous materials and toxic substances.

B. Selective demolition of building elements for alteration purposes.

1.02 RELATED REQUIREMENTS

A. Section 01 10 00 - Summary: Limitations on Contractor's use of site and premises.

B. Section 01 10 00 - Summary: Description of items to be salvaged or removed for re-use by Contractor.

C. Section 01 50 00 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.

D. Section 01 60 00 - Product Requirements: Handling and storage of items removed for salvage and relocation.

E. Section 01 70 00 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.

F. Section 07 01 50.19 - Preparation for Re-Roofing: Removal of existing roofing, roof insulation, flashing, trim, and accessories.

G. Section 31 22 00 - Grading: Fill material for filling holes, pits, and excavations generated as a result of removal operations.

H. Section 31 23 23 - Fill: Fill material for filling holes, pits, and excavations generated as a result of removal operations.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Site Plan: Showing:
   1. Areas for temporary construction and field offices.

C. Demolition Plan: Submit demolition plan.
   1. Indicate extent of demolition, removal sequence, bracing and shoring, and location and construction of barricades and fences.
   2. Identify demolition firm and submit qualifications.
   3. Include a summary of safety procedures.

D. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

1.04 QUALITY ASSURANCE

A. Demolition Firm Qualifications: Company specializing in the type of work required.
   1. Minimum of five years of documented experience.

PART 3 EXECUTION

2.01 SCOPE

A. Remove:
   1. All storefront and curtain wall systems including glazing, frames and doors.
   2. All acoustic ceilings
   3. Walls, doors, interior partitions as indicated
   4. Floor finishes as indicated
   5. Case work as indicated

B. Remove other items indicated, for salvage and relocation.

C. Fill excavations, open pits, and holes in ground areas generated as result of removals, using specified fill; compact fill as specified in Section 31 22 00.

2.02 GENERAL PROCEDURES AND PROJECT CONDITIONS

A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
   1. Obtain required permits.
   2. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
   3. Provide, erect, and maintain temporary barriers and security devices.
   4. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.
   5. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
   6. Do not close or obstruct roadways or sidewalks without permit.
   7. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.
   8. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon or limit access to their property.

B. Do not begin removal until receipt of notification to proceed from Owner.

C. Protect existing structures and other elements that are not to be removed.
   1. Provide bracing and shoring.
   2. Prevent movement or settlement of adjacent structures.
   3. Stop work immediately if adjacent structures appear to be in danger.
   4. Provide temporary weather barriers as required to prevent moisture and rain from entering building

D. If hazardous materials are discovered during removal operations, stop work and notify Architect and Owner; hazardous materials include regulated asbestos containing materials, lead, PCB's, and mercury.

E. Perform demolition in a manner that maximizes salvage and recycling of materials.
   1. Dismantle existing construction and separate materials.
   2. Set aside reusable, recyclable, and salvageable materials; store and deliver to collection point or point of reuse.

2.03 EXISTING UTILITIES

A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.

B. Protect existing utilities to remain from damage.

C. Do not disrupt public utilities without permit from authority having jurisdiction.

D. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner.

E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.

F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.

G. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.

2.04 SELECTIVE DEMOLITION FOR ALTERATIONS

A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
   1. Verify that construction and utility arrangements are as shown.
   2. Report discrepancies to Architect before disturbing existing installation.
   3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.

B. Remove existing work as indicated and as required to accomplish new work.
   1. Remove items indicated on drawings.

C. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove existing systems and equipment as indicated.
   1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components.
   2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
   3. Verify that abandoned services serve only abandoned facilities before removal.
   4. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification.

D. Protect existing work to remain.
   1. Prevent movement of structure; provide shoring and bracing if necessary.
   2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
   3. Repair adjacent construction and finishes damaged during removal work.
   4. Patch as specified for patching new work.

2.05 DEBRIS AND WASTE REMOVAL

A. Remove debris, junk, and trash from site.

B. Leave site in clean condition, ready for subsequent work.

C. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION

SECTION 03 01 00

MAINTENANCE OF CONCRETE (BID ALTERNATE 1)

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cleaning of existing concrete surfaces.

1.02 RELATED REQUIREMENTS

A. Section 01 23 00 - Alternates: Alternate 1

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Indicate product standards, physical and chemical characteristics, technical specifications, limitations, maintenance instructions, and general recommendations regarding each material.

1.04 QUALITY ASSURANCE

A. Cleaner Qualifications: Company specializing in, and with minimum of 3 years of experience in, the type of cleaning specified.

1.05 MOCK-UP(S)

A. Locate mock-up(s) where directed.

B. Re-work mock-up(s) until satisfactory to Owner.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturers' instructions for storage, shelf life limitations, and handling of products.

PART 2 PRODUCTS

2.01 CLEANING MATERIALS

A. Acidic Cleaning Agent: muriatic acid.

PART 3 EXECUTION

3.01 CLEANING EXISTING CONCRETE

A. Provide enclosures, barricades, and other temporary construction as required to protect adjacent work from damage.

B. Use a pressure washer with acidic cleaning agent applied for the least amount of time that is effective, followed by water rinse. Test acidic cleaning agents on mock-up surfaces prior to use.

C. Inspect existing sealant joints with Owner prior to initiating work. Document areas where sealant is missing or pulled away from concrete. Do not disturb, destroy sealant joints during pressure washing. Prevent water from entering building.

END OF SECTION

SECTION 03 30 00
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete formwork.

B. Floors and slabs on grade.

C. Concrete reinforcement.

D. Joint devices associated with concrete work.

E. Miscellaneous concrete elements, including equipment pads.

F. Concrete curing.

1.02 RELATED REQUIREMENTS

A. Division 22 - Plumbing: New underground plumbing

1.03 PRICE AND PAYMENT PROCEDURES

A. See Section 01 22 00 - Unit Prices, for additional unit price requirements.

B. Lean Concrete Slurry (Controlled Density Fill) to fill underslab ducts: Include , reinforcement , materials, placement accessories, consolidating, and curing. Measurement by:
   1. Cubic yard.

1.04 REFERENCE STANDARDS

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

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

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

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

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

F. ACI 305R - Hot Weather Concreting; American Concrete Institute International; 2010.

G. ACI 306R - Cold Weather Concreting; American Concrete Institute International; 2010.

H. ACI 308R - Guide to Curing Concrete; American Concrete Institute International; 2001 (Reapproved 2008).

I. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; American Concrete Institute International; 2011.

J. ACI 347 - Guide to Formwork for Concrete; American Concrete Institute International; 2004.

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

L. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2014.

M. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2014.

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

O. ASTM C150/C150M - Standard Specification for Portland Cement; 2012.

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

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

R. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete; 2011.

S. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2012.

T. ASTM E1155 - Standard Test Method for Determining F(F) Floor Flatness and F(L) Floor Levelness Numbers; 1996 (Reapproved 2008).

1.05 SUBMITTALS

A. See Section 01 30 00 - 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. Design Mix:
   1. Submit concrete design mix
   2. Submit Controlled Density Fill mix Design

D. Samples: Submit samples of underslab vapor retarder to be used.

E. Project Record Documents: Accurately record actual locations of embedded utilities and components that will be concealed from view upon completion of concrete work.

1.06 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI 301 and ACI 302.1R.

B. Acquire cement from same source and aggregate from same source for entire project.

C. Follow recommendations of ACI 305R when concreting during hot weather.

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

E. Pre-Installation meeting: 48 hours before starting work of this section review concrete pour procedures, schedule, cold weather mix and coordination with other work.

1.07 COORDINATION

A. Underground Plumbing: Coordinate work with underground plumbing

B. Fill of underground duct system: Coordinate fill of underground duct with installation of new HVAC systems

PART 2 PRODUCTS

2.01 FORMWORK

A. Formwork Design and Construction: Comply with guidelines of ACI 347 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.

2.02 REINFORCEMENT

A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi).
   1. Type: Deformed billet-steel bars.
   2. Finish: Unfinished, unless otherwise indicated.

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

2.03 CONCRETE MATERIALS

A. Cement: ASTM C150, Type II - Moderate Portland type.
   1. Acquire all cement for entire project from same source.

B. Fine and Coarse Aggregates: ASTM C 33.
   1. Acquire all aggregates for entire project from same source.

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

D. Water: Clean and not detrimental to concrete.

2.04 ADMIXTURES

A. Chemical Admixture Manufacturers: Any that meet the requirements of this section

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

C. Air Entrainment Admixture: ASTM C260/C260M.

D. High Range Water Reducing and Retarding Admixture: ASTM C494/C494M Type G.

2.05 ACCESSORY MATERIALS

A. Underslab Vapor Retarder: 15 mils thick polyolefin material o
   1. Stegowrap from Stego Industries
   2. Perminator from W.R. Meadows
   3. Substitutions: See Section 01 60 00 - Product Requirements.

B. Non-Shrink Cementitious Grout: Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.
   1. Minimum Compressive Strength at 28 Days: 7,000 psi.

2.06 BONDING AND JOINTING PRODUCTS

A. 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.

B. Joint Filler: Nonextruding, resilient asphalt impregnated fiberboard or felt, complying with ASTM D 1751, 1/4 inch thick and 4 inches deep; tongue and groove profile.

2.07 CURING MATERIALS

A. Curing Compound, Naturally Dissipating: Clear, water-based, liquid membrane-forming compound; complying with ASTM C309.
   1. Product dissipates within 4 to 6 weeks.
   2. Products:
      a. Dayton Superior Corporation; Clear Resin Cure J11W: www.daytonsuperior.com.
      b. Kaufman Products Inc.; Thinfilm 420 Resin Base: www.kaufmanproducts.net.
      c. SpecChem, LLC; SpecRez: www.specchemllc.com.
      d. W.R. Meadows, Inc.; 1100-Clear: www.wrmeadows.com.

B. Moisture-Retaining Sheet: ASTM C171.
   1. Curing paper, regular.
   2. Polyethylene film, clear, minimum nominal thickness of 0.0040 in..
   3. White-burlap-polyethylene sheet, weighing not less than 10 oz/per linear yd, 40 inches wide.

C. Water: Potable, not detrimental to concrete.

D. Concrete Repair: Fusion Crete

2.08 CONCRETE MIX DESIGN

A. Proportioning Medium Weight Concrete: Comply with ACI 211.1 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. Fly Ash Content: Maximum 15 percent of cementitious materials by weight.
2. Maximum Slump: 4 to 5 inches.
3. Aggregate: 3/4 inch minus for interior slabs on grades, 3/4 inch minus for footings and foundations, exterior slabs on grade, interior slabs on grades less than 6 inches thick.
4. Water Cement Ratio: 0.48
5. Air entrainment: 2% for interior slabs and 6% for exterior slabs.

2.09 LEAN CONCRETE (CONTROLLED DENSITY FILL) DESIGN MIX

A. Cement: Between 40 and 100 pounds per cubic yard

B. Fly ash: Minimum 250 pounds per cubic yard

C. Water: As required for flowability

D. Air Entrainment: Between 12 percent and 18 percent

E. Aggregate: ASTM 33- well graded concrete sand

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. Verify that forms are clean and free of rust before applying release agent.

C. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.

D. 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.

E. Install vapor retarder under interior slabs on grade. Lap joints minimum 6 inches or other minimum dimension as described in manufacturer's printed instructions. Install according to manufacturer's printed instructions. Cover with sand to depth shown on drawings; repair damaged vapor retarder before covering.

3.03 INSTALLING REINFORCEMENT AND OTHER EMBEDDED ITEMS

A. Comply with requirements of ACI 301. Clean reinforcement of loose rust and mill scale, and accurately position, support, and secure in place to achieve not less than minimum concrete coverage required for protection.

3.04 PLACING CONCRETE

A. Place concrete in accordance with ACI 304R.

B. Place concrete for floor slabs in accordance with ACI 302.1R.

C. Notify Architect not less than 24 hours prior to commencement of placement operations.

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

E. Finish floors level and flat, unless otherwise indicated, within the tolerances specified below.

3.05 SLAB JOINTING

A. Locate joints as indicated on the 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. Repair underslab vapor retarder damaged during placement of concrete reinforcing. Repair with vapor retarder material; lap over damaged areas minimum 6 inches and seal watertight.

E. Separate slabs on grade from vertical surfaces with joint filler.

F. Place joint filler in floor slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.

G. Extend joint filler from bottom of slab to within 1/2 inch of finished slab surface. Conform to Section 07 90 05 for finish joint sealer requirements.

H. Install joint devices in accordance with manufacturer's instructions.

I. Screed floors level, maintaining surface flatness of maximum 1/8 inch in 10 ft.

3.06 FLOOR FLATNESS AND LEVELNESS TOLERANCES

A. An independent testing agency, as specified in Section 01 40 00, will inspect finished slabs for conformance to specified tolerances.

B. Maximum Variation of Surface Flatness:
   1. Exposed Concrete Floors: 1/8 inch in 10 ft.
   2. Under Seamless Resilient Flooring: 1/8 inch in 10 ft.
   3. Under Carpeting: 1/8 inch in 10 ft.

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

D. 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.

3.07 CONCRETE FINISHING

A. Concrete Slabs: Finish to requirements of ACI 302.1R, and as follows:
   1. Surfaces to Receive Thin Floor Coverings: "Steel trowel" as described in ACI 302.1R; thin floor coverings include carpeting, resilient flooring, seamless flooring, thin set quarry tile, and thin set ceramic tile.
   2. Other Surfaces to Be Left Exposed: "Steel trowel" as described in ACI 302.1R, minimizing burnish marks and other appearance defects.

B. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains at 1:100 nominal.

C. Form Tie Fill: Install per manufacturers specification at scheduled locations.

3.08 CURING AND PROTECTION

A. Minimum Traffic Duration: Concrete must cure 7 days prior to pedestrian traffic and 14 days prior to heavy traffic and 28 days prior to erecting pre-engineered metal building.

B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

C. Surfaces Not in Contact with Forms including slab on grade:
   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 or water-fog spray.
      a. 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 provide one of the following:
      a. Moisture-Retaining Sheet: Lap strips not less than 3 inches and seal with waterproof tape or adhesive; secure at edges.
      b. Moisture-Retaining Cover: Seal in place with waterproof tape or adhesive.
      c. Curing Compound: Apply in two coats at right angles, using application rate recommended by manufacturer.

3.09 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00.

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 conformance with specified requirements.

E. Compressive Strength Tests: ASTM C 39/C 39M. For each test, mold and cure three concrete test cylinders. Obtain test samples for every 75 cu yd or less of each class of concrete placed and for at least one set for each days pour.

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 every 30 yards of concrete poured. If concrete of any one truck does not pass then test every truck. This constitutes additional testing under paragraph 3.07. Do not place concrete for any truck that does not meet slump requirements.

H. Provide continuous inspection during placement.

I. The testing agency has full authority to reject concrete that does not meet the specifications herein. This concrete is deemed defective and the costs of replacement will be borne by the General Contractor.

3.10 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 conforming to 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.

3.11 SCHEDULE - CONCRETE TYPES AND FINISHES

A. Foundations and footing: f'c= 3,500 psi 28 day concrete design strength.

B. Interior slab on grade: f'c=4,000 psi 28 day concrete design strength

C. Site Concrete: 4,000 psi 28 day concrete design strength

END OF SECTION

SECTION 05 12 00
STRUCTURAL STEEL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Structural steel framing members, support members.

B. Base plates, Angles.

C. Grouting under base plates.

1.02 RELATED REQUIREMENTS

A. Section 01 40 00 Quality Requirements - Testing

1.03 REFERENCE STANDARDS

A. AISC (MAN) - Steel Construction Manual; American Institute of Steel Construction, Inc.; 2011.

B. AISC S303 - Code of Standard Practice for Steel Buildings and Bridges; American Institute of Steel Construction, Inc.; 2010.

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

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

E. ASTM A325M - Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Minimum Tensile Strength (Metric); 2014.

F. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts; 2007a (Reapproved 2014).

G. ASTM A563M - Standard Specification for Carbon and Alloy Steel Nuts [Metric]; 2007.

H. ASTM A992/A992M - Standard Specification for Structural Steel Shapes; 2011.

I. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2014.

J. ASTM E164 - Standard Practice for Contact Ultrasonic Testing of Weldments; 2013.

K. ASTM F436 - Standard Specification for Hardened Steel Washers; 2011.

L. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength; 2007a.

M. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; American Welding Society; 2012.

N. AWS D1.1/D1.1M - Structural Welding Code - Steel; American Welding Society; 2011 w/Errata.

O. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel; International Accreditation Service, Inc.; 2011.

P. RCSC (HSBOLT) - Specification for Structural Joints Using High-Strength Bolts; Research Council on Structural Connections; 2009.

Q. SSPC-Paint 15 - Steel Joist Shop Primer; Society for Protective Coatings; 1999 (Ed. 2004).

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings:
   1. Indicate profiles, sizes, spacing, locations of structural members, openings, attachments, and fasteners.
   2. Connections not detailed.
   3. Indicate cambers and loads.
   4. Indicate welded connections with AWS A2.4 welding symbols. Indicate net weld lengths.

C. Manufacturer's Mill Certificate: Certify that products meet or exceed specified requirements.

D. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within the previous 12 months.

E. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172.

1.05 QUALITY ASSURANCE

A. Fabricate structural steel members in accordance with AISC "Steel Construction Manual."

B. Comply with Section 10 of AISC "Code of Standard Practice for Steel Buildings and Bridges" for architecturally exposed structural steel.

C. Fabricator Qualifications: A qualified steel fabricator that is accredited by the International Accreditation Service (IAS) Fabricator Inspection Program for Structural Steel (AC172).

D. Design connections not detailed on the drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located.

PART 2 PRODUCTS

2.01 MATERIALS

A. Steel Angles and Plates: ASTM A36/A36M.

B. Steel W Shapes and Tees: ASTM A992/A992M.

C. High-Strength Structural Bolts, Nuts, and Washers: ASTM A325 or A325M, Type 1, medium carbon, galvanized, with matching compatible ASTM A563 or A563M nuts and ASTM F436 washers.

D. Unheaded Anchor Rods: ASTM F1554, Grade 36, plain, with matching ASTM A563 or A563M nuts and ASTM F436 Type 1 washers.

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

F. Grout: Non-shrink, non-metallic aggregate type, complying with ASTM C1107/C1107M and capable of developing a minimum compressive strength of 7,000 psi at 28 days. Provide Non-Shrink manufactured by Sakrete or equivalent.

G. Shop and Touch-Up Primer: Fabricator's standard, complying with VOC limitations of authorities having jurisdiction.

2.02 FABRICATION

A. Shop fabricate to greatest extent possible.

B. Continuously seal joined members by continuous welds. Grind exposed welds smooth.

C. Fabricate connections for bolt, nut, and washer connectors.

D. Develop required camber for members.

2.03 FINISH

A. Prepare structural component surfaces in accordance with SSPC SP 15.

B. Shop prime structural steel members. Do not prime surfaces that will be fireproofed, field welded, in contact with concrete, or high strength bolted.

PART 3 EXECUTION

3.01 ERECTION

A. Erect structural steel in compliance with AISC "Code of Standard Practice for Steel Buildings and Bridges".

B. Grout solidly between column plates and bearing surfaces, complying with manufacturer's instructions for nonshrink grout. Trowel grouted surfaces smooth, splaying neatly to 45 degrees.

3.02 TOLERANCES

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

3.03 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00.

B. High-Strength Bolts: Provide testing and verification of field-bolted connections in accordance with RCSC "Specification for Structural Joints Using High-Strength Bolts", testing at least 100 percent of bolts at each connection.

C. Welded Connections: Visually inspect all field-welded connections and test at least 100 percent of welds using one of the following:
   1. Ultrasonic testing performed in accordance with ASTM E164.

END OF SECTION

SECTION 05 40 00
COLD-FORMED METAL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Formed steel stud and costume shaped exterior wall framing.

B. Formed steel joist framing and bridging.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Roof and wall sheathing.

B. Section 07 21 00 - Thermal Insulation: Insulation within framing members.

C. Section 07 42 14 Insulated Metal Wall Panels: Wall and soffit panels installed over metal wall framing

D. Section 07 62 00 - Sheet Metal Flashing and Trim: Head and sill flashings.

E. Section 09 21 16 - Gypsum Board Assemblies: Lightweight, non-load bearing metal stud framing.

1.03 REFERENCE STANDARDS

A. AISI S100-12 - North American Specification for the Design of Cold-Formed Steel Structural Members; American Iron and Steel Institute; 2012.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2013.

D. ASTM C955 - Standard Specification for Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases; 2011c.

E. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories; 2011a.

F. AWS D1.1/D1.1M - Structural Welding Code - Steel; American Welding Society; 2011 w/Errata.

G. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); Society for Protective Coatings; 2002 (Ed. 2004).

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on standard framing members; describe materials and finish, product criteria, limitations .

C. Shop Drawings: Indicate component details, framed openings, bearing, anchorage, loading, welds, and type and location of fasteners, and accessories or items required of related work.
   1. Indicate stud and ceiling joist layout.
   2. Describe method for securing studs to tracks and for bolted framing connections.
   3. Provide calculations for loadings and stresses of specially fabricated framing, stamped by a Professional Structural Engineer.
   4. Provide details and calculations for factory-made framing connectors, stamped by a Professional Structural Engineer.

D. Manufacturer's Installation Instructions: Indicate special procedures, conditions requiring special attention .

1.05 QUALITY ASSURANCE

A. Designer Qualifications: Design framing system under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in the State in which the Project is located.

B. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, and with minimum three years of documented experience.

C. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience and approved by manufacturer.

1.06 MOCK-UP

A. Provide mock-up of exterior framed wall, including components specified elsewhere, such as insulation, sheathing, window frame, exterior wall finish, and interior wall finish.

B. Mock-Up Size: As indicated on the drawings.

C. Location: As indicated on the drawings.

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

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Framing:
1. CEMCO: www.cemcosteel.com.
2. Clarkwestern Dietrich Building Systems LLC: www.clarkdietrich.com.
3. Marino: www.marinoware.com.
4. The Steel Network, Inc: www.SteelNetwork.com.
5. SCAFCO Steel Stud Company: www.SCAFCO.com
6. Substitutions: See Section 01 60 00 - Product Requirements.

B. Framing Connectors and Accessories:
1. Same manufacturer as metal framing.
2. Simpson Strong Tie: www.strongtie.com.
3. Concrete Fastenner's Inc; Tapcon; www.concretefasteners.com
4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 FRAMING SYSTEM

A. Provide primary and secondary framing members, bridging, bracing, plates, gussets, clips, fittings, reinforcement, and fastenings as required to provide a complete framing system.

B. Design Criteria: Provide completed framing system having the following characteristics:
1. Design: Calculate structural characteristics of cold-formed steel framing members according to AISI S100-12.
2. Structural Performance: Design, engineer, fabricate, and erect to withstand specified design loads for project conditions within required limits.
3. Design Loads: In accordance with applicable codes.
4. Live load deflection meeting the following, unless otherwise indicated:
5. Able to tolerate movement of components without damage, failure of joint seals, undue stress on fasteners, or other detrimental effects when subject to seasonal or cyclic day/night temperature ranges.
6. Able to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.

C. Shop fabricate framing system to the greatest extent possible.

D. Deliver to site in largest practical sections.

2.03 FRAMING MATERIALS

A. Studs, Track and Furring: ASTM C955; studs formed to channel, "C", or "Sigma" shape with punched web; U-shaped track in matching nominal width and compatible height. Custom Z-shaped furring for support of insulated wall panels.
1. Gage and Depth: Gage and depth and spacing are are indicated on the drawings as minimums. Provide gage and stud spacing as required to meet specified performance levels. Notify architect if an increase depth is required to meet performance levels
2. Galvanized in accordance with ASTM A653/A653M, G90/Z275 coating.

B. Joists and Purlins: Fabricated from ASTM A653/A653M steel sheet, with G90/Z275 hot dipped galvanized coating.
   1. Gage and Depth: Gage and depth and spacing are are indicated on the drawings as minimums. Provide gage and joist spacing as required to meet specified performance levels. Notify architect if an increase depth is required to meet performance levels

C. Framing Connectors: Factory-made, formed steel sheet.
   1. Material: ASTM A653/A653M SS Grade 33 and 40 (minimum), with G90/Z275 hot dipped galvanized coating for base metal thickness less than 10 gage, 0.1345 inch, and factory punched holes and slots.
   2. Structural Performance: Maintain load and movement capacity required by applicable code, when evaluated in accordance with AISI S100-12.
   3. Fixed Connections: Provide non-movement connections for tie-down to foundation, floor-to-floor tie-down, roof-to-wall tie-down, joist hangers, gusset plates, and stiffeners.
   4. Wall Stud Bridging Connections: Provide mechanical load-transferring devices that accommodate wind load torsion and weak axis buckling induced by axial compression loads. Provide bridging connections as required to meet performance requirements.

2.04 ACCESSORIES

A. Bracing, Furring, Bridging: Formed sheet steel, thickness determined for conditions encountered; finish to match framing components.

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

2.05 FASTENERS

A. Self-Drilling, Self-Tapping Screws, Bolts, Nuts and Washers: Hot dip galvanized per ASTM A153/A153M.

B. Anchorage Devices: Drilled expansion bolts and Drilled screws.

C. Welding: In conformance with AWS D1.1/D1.1M.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

3.02 INSTALLATION OF STUDS

A. Install components in accordance with manufacturers' instructions and ASTM C1007 requirements.

B. Align floor and ceiling tracks; locate to wall layout. Secure in place with fasteners at maximum 24 inches on center. Coordinate installation of sealant with floor and ceiling tracks.

C. Place studs at 16 inches on center; not more than 2 inches from abutting walls and at each side of openings. Connect studs to tracks using clip and tie method.

D. Construct corners using minimum of three studs. Install double studs at wall openings, door and window jambs.

E. Install load bearing studs, brace, and reinforce to develop full strength and achieve design requirements.

F. Coordinate placement of insulation in multiple stud spaces made inaccessible after erection.

G. Install intermediate studs above and below openings to align with wall stud spacing.

H. Install framing between studs for attachment of mechanical and electrical items, and to prevent stud rotation.

3.03 INSTALLATION OF JOISTS AND PURLINS

A. Install framing components in accordance with manufacturer's instructions.

B. Make provisions for erection stresses. Provide temporary alignment and bracing.

C. Place joists at 16 inches on center; not more than 2 inches from abutting walls. Connect joists to supports using fastener method.

D. Set ceiling joists parallel and level, with lateral bracing and bridging.

E. Provide web stiffeners at reaction points.

F. Touch-up field welds and damaged galvanized surfaces with primer.

END OF SECTION

SECTION 05 50 00
METAL FABRICATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Shop fabricated steel items.

1.02 RELATED REQUIREMENTS

A. Section 05 12 00 - Structural Steel Framing: Structural steel column anchor bolts.

B. Section 08 43 13 - Aluminum Framed Storefront: Metal plates and angles to support storefront system.

1.03 PRICE AND PAYMENT PROCEDURES

A. See Section 01 22 00 - Unit Prices, for additional requirements.

B. Components:
   1. Basis of Measurement for the Wall Bracing: By the unit.
   2. Basis of Payment: Includes fabrication, finishing, and installation.

1.04 REFERENCE STANDARDS

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

B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2013.

C. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2013.

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

E. ASTM A325M - Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Minimum Tensile Strength (Metric); 2014.

F. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2013.

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

H. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; American Welding Society; 2012.

I. AWS D1.1/D1.1M - Structural Welding Code - Steel; American Welding Society; 2011 w/Errata.

J. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel; International Accreditation Service, Inc.; 2011.

K. SSPC-Paint 15 - Steel Joist Shop Primer; Society for Protective Coatings; 1999 (Ed. 2004).

L. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); Society for Protective Coatings; 2002 (Ed. 2004).

1.05 SUBMITTALS

A. See Section 01 30 00 - 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.

C. Welders' Certificates: Submit certification for welders employed on the project, verifying AWS qualification within the previous 12 months.

D. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172.

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.

D. Fasteners: Expansion Anchors as indicated.

E. Bolts, Nuts, and Washers: ASTM A325 (ASTM A325M), Type 1, plain.

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

G. 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. Continuously seal joined members by continuous welds.

D. 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.

E. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

F. 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. Steel Ledge Angles, Shelf Angles, Channels, and Plates Not Attached to Structural Framing: For support of storefront system; galvanized finish.

B. Slotted Channel Framing: Fabricate channels and fittings from structural steel complying with the referenced standards; Stainless Steel for exterior applications and electro galvanized for interior applications finish.
   1. Wall Bracing: Manufacturer: Unistrut: Product Seismic Bracing System
   2. Exterior Duct Support: Manufacturer: Unistrut: Product: 1 5/8 channels x 12 gage channels with angle supports in each corner

2.04 FINISHES - STEEL

A. Galvanizing of Structural Steel Members: Galvanize after fabrication to ASTM A123/A123M requirements. Provide minimum 1.7 oz/sq ft galvanized coating.

B. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123/A123M requirements.

2.05 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 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

3.03 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.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/8 inch.

C. Maximum Out-of-Position: 1/8 inch.

END OF SECTION

SECTION 06 10 00
ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Non-structural dimension lumber framing.

B. Sheathing.

C. Preservative treated wood materials.

D. Fire retardant treated wood materials.

E. Concealed wood blocking, nailers, and supports.

F. Miscellaneous wood nailers, furring, and grounds.

1.02 RELATED REQUIREMENTS

A. Section 08 43 13 Aluminum Framed Storefront: Wood for support for curtain wall system

1.03 REFERENCE STANDARDS

A. AFPA (WFCM) - Wood Frame Construction Manual for One- and Two-Family Dwellings; American Forest and Paper Association; 2012.

B. AWPA U1 - Use Category System: User Specification for Treated Wood; American Wood Protection Association; 2012.

C. PS 2 - Performance Standard for Wood-Based Structural-Use Panels; National Institute of Standards and Technology, U.S. Department of Commerce; 2010.

D. PS 20 - American Softwood Lumber Standard; National Institute of Standards and Technology, Department of Commerce; 2010.

E. WWPA G-5 - Western Lumber Grading Rules; Western Wood Products Association; 2011.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide technical data on wood preservative materials and application instructions.

C. Manufacturer's Certificate: Certify that wood products supplied for rough carpentry meet or exceed specified requirements.

1.05 DELIVERY, STORAGE, AND HANDLING

A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

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.

B. Lumber fabricated from old growth timber is not permitted.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

A. Grading Agency: Western Wood Products Association (WWPA).

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

C. Moisture Content: S-dry or MC19.

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

2.03 CONSTRUCTION PANELS

A. Roof Sheathing: Any PS 2 type, rated Structural I Sheathing.
   1. Bond Classification: Exterior.
   2. Span Rating: 60.
   3. Performance Category: 3/4 PERF CAT.

2.04 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. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.
   2. 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. Fire Retardant Treatment:

C. Preservative Treatment:
   1. Preservative Pressure Treatment of Lumber Above Grade: AWPA U1, Use Category UC3B, Commodity Specification A using waterborne preservative to 0.25 lb/cu ft retention.
      a. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
      b. Treat lumber in contact with roofing, flashing, waterproofing, or storefront system.
   2. Preservative Pressure Treatment of Plywood Above Grade: AWPA U1, Use Category UC2 and UC3B, Commodity Specification F using waterborne preservative to 0.25 lb/cu ft retention.
      a. Kiln dry plywood after treatment to maximum moisture content of 19 percent.
      b. Treat plywood in contact with roofing, flashing, or waterproofing.

PART 3 EXECUTION

3.01 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.

3.02 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 AFPA Wood Frame Construction Manual.

E. Construct double joist headers at floor and ceiling openings and under wall stud partitions that are parallel to floor joists; use metal joist hangers unless otherwise detailed.

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

3.03 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 metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.

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. Handrails.
   4. Grab bars.
   5. Towel and bath accessories.
   6. Wall-mounted door stops.
   7. Chalkboards and marker boards.
   8. Wall paneling and trim.
   9. Joints of rigid wall coverings that occur between studs.

3.04 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.

3.05 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.

3.06 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.

3.07 CLEANING

A. Waste Disposal: Comply with the requirements of Section 01 74 19.
   1. Comply with applicable regulations.
   2. Do not burn scrap on project site.
   3. Do not burn scraps that have been pressure treated.
   4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or “waste-to-energy” facilities.

B. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.

C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION

SECTION 06 41 00

ARCHITECTURAL WOOD CASEWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Specially fabricated cabinet units.

B. Plastic Laminate Countertops.

C. Cabinet hardware.

D. Preparation for installing utilities.

1.02 RELATED REQUIREMENTS

A. Section 06 1114 Wood Blocking and Curbing: Wood blocking to support casework

B. Section 12 3600 Counter Tops: Solid Surface Counter Tops

1.03 REFERENCE STANDARDS

A. ANSI A208.1 - American National Standard for Particleboard; 2009.

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

C. AWI (QCP) - Quality Certification Program, www.awiqcp.org; current edition at www.awiqcp.org.

D. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.

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

F. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood; Hardwood Plywood & Veneer Association; 2009 (ANSI/HPVA HP-1).

G. NEMA LD 3 - High-Pressure Decorative Laminates; National Electrical Manufacturers Association; 2005.

H. WI (CCP) - Certified Compliance Program (CCP); current edition at www.woodworkinstitute.com/certification.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting not less than one week before starting work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, hardware locations and accessories.
   1. Minimum Scale of Detail Drawings: 1-1/2 inch to 1 foot.
   2. Provide the information required by AWI/AWMAC/WI (AWS).

C. Product Data: Provide data for hardware accessories.

D. Samples: Submit actual samples of architectural cabinet construction, minimum 12 inches square, illustrating proposed cabinet, countertop, and shelf unit substrate and finish.

E. Samples: Submit actual sample items of proposed pulls, hinges, shelf standards, and locksets, demonstrating hardware design, quality, and finish.

1.06 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.
   1. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.

B. Quality Certification: Provide AWI Quality Certification Program (QCP) inspection report and quality certification of completed work.
   1. Provide labels or certificates indicating that the work complies with requirements of AWS Grade or Grades specified.
   2. This project has been registered as AWI/QCP project number _____.
   3. Prior to delivery to the site provide shop drawings with certification labels.
   4. Provide labels on each product when required by certification program.
   5. Upon completion of installation provide certificate certifying that the installation and products meet the specified requirements.
   6. Arrange and pay for inspections required for certification.
   7. Replace, repair, or rework all work for which certification is refused.

1.07 MOCK-UP

A. Provide mock-up of typical base cabinet, wall cabinet, and countertop, including hardware, finishes, and plumbing accessories.

B. Locate where directed.

C. Mock-up may remain as part of the Work.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Protect units from moisture damage.

1.09 FIELD CONDITIONS

A. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Any that meet the requirements of this section.

B. Single Source Responsibility: Provide and install this work from single fabricator.

2.02 CABINETS

A. Quality Grade: Unless otherwise indicated provide products of quality specified by AWI//AWMAC/WI (AWS) for Premium Grade.

B. Plastic Laminate Faced Cabinets: Custom grade.

C. Breakroom Cabinets: Plastic laminate faced, Custom grade.

D. Cabinets at all locations:
   1. Finish - Concealed Surfaces: Manufacturer's option.
   2. Door and Drawer Front Edge Profiles: Square edge with thin applied band.
   3. Casework Construction Type: Type A - Frameless.
   4. Cabinet Style: Flush overlay.
   5. Cabinet Doors and Drawer Fronts: Flush style.
   6. Drawer Construction Technique: Dovetail joints.

2.03 LAMINATE MATERIALS

A. Manufacturers:
   1. Formica Corporation; ____: www.formica.com.
   2. Panolam Industries International, Inc\Nevamar; ____: www.nevamar.com.
   3. Wilsonart, LLC; ____: www.wilsonart.com.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications.

C. Provide specific types as follows:
   1. Horizontal Surfaces: HGS, 0.048 inch nominal thickness, through color, color as selected, finish as selected.

2. Vertical Surfaces: VGS, 0.028 inch nominal thickness, through color, color as selected, finish as scheduled.
3. Cabinet Liner: CLS, 0.020 inch nominal thickness, through color, colors as scheduled, finish as scheduled.
4. Laminate Backer: BKL, 0.020 inch nominal thickness, undecorated; for application to concealed backside of panels faced with high pressure decorative laminate.

2.04 COUNTERTOPS

A. Plastic Laminate Countertops: Medium density fiberboard substrate covered with HPDL, conventionally fabricated and self-edge banded.

2.05 ACCESSORIES

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

B. Plastic Edge Banding: Extruded PVC, convex shaped; smooth finish; self locking serrated tongue; of width to match component thickness.
1. Color: As selected by Architect from manufacturer's standard range.
2. Use at all exposed edges with plastic laminate faces.

C. Fasteners: Size and type to suit application.

D. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized or chrome-plated finish in concealed locations and stainless steel or chrome-plated finish in exposed locations.

E. Concealed Joint Fasteners: Threaded steel.

F. Grommets: Standard plastic, painted metal, or rubber grommets for cut-outs, in color to match adjacent surface.

2.06 HARDWARE

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

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

C. Cabinet Locks: Keyed cylinder, two keys per lock, master keyed, steel with chrome finish.
1. Product: DCR Reversible Cam Lock manufactured by Olympus. Lock size to fit panel thickness

D. Catches: Magnetic.

E. Drawer Slides:
1. Type: Full extension.
2. Static Load Capacity: Heavy Duty grade.
3. Mounting: Side mounted.
4. Stops: Integral type.
5. Features: Provide self closing/stay closed type.

F. Hinges: European style concealed self-closing type, 120 degree operation, steel with polished finish.

2.07 FABRICATION

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

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

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

D. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs.
1. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.

2. Cap exposed plastic laminate finish edges with material of same finish and pattern.

E. Mechanically fasten back splash to countertops as recommended by laminate manufacturer at 16 inches on center.

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.

3.05 SCHEDULES

A. Provide Casework as indicated

END OF SECTION

SECTION 07 01 50.19
PREPARATION FOR RE-ROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Removal of existing roofing system in preparation for a new roof membrane system.

1.02 REFERENCE STANDARDS

A. ASTM C208 - Standard Specification for Cellulosic Fiber Insulating Board; 2012.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with affected mechanical and electrical work associated with roof penetrations.

B. Preinstallation Meeting: Convene one week before starting work of this section.

C. Schedule work to coincide with commencement of installation of new roofing system.

1.04 QUALITY ASSURANCE

1.05 FIELD CONDITIONS

A. Do not remove existing roofing membrane when weather conditions threaten the integrity of the building contents or intended continued occupancy.

B. Maintain continuous temporary protection prior to and during installation of new roofing system.

PART 3 EXECUTION

2.01 EXAMINATION

A. Verify that existing roof surface is clear and ready for work of this section.

2.02 PREPARATION

A. Sweep roof surface clean of loose matter.

B. Remove loose refuse and dispose off site.

2.03 MATERIAL REMOVAL

A. Remove only existing roofing materials that can be replaced with new materials the same day.

B. Remove metal counter flashings.

C. Remove damaged portions of roofing membrane, perimeter base flashings, flashings around roof protrusions, pitch pans and pockets.

D. Remove damaged insulation and fasteners, cant strips, and blocking.

E. Remove vapor retarder.

2.04 FIELD QUALITY CONTROL

2.05 PROTECTION

A. Install recovery board over existing membrane.

END OF SECTION

SECTION 07 21 00
THERMAL INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Board insulation at cavity wall construction and under roof deck and infill of storefront system.

B. Batt insulation in exterior wall and roof construction.

1.02 RELATED REQUIREMENTS

A. Section 05 40 00 - Cold-Formed Metal Framing: Batt Insulation within steel framed walls.

B. Section 07 21 19 - Foamed-In-Place Insulation: Foam insulation filling perimeter window, door and crevices in exterior wall and roof.

C. Section 08 43 13 Storefront: Board Insulation installed in aluminum frames and adhered to aluminum panels installed in the aluminum window frames

1.03 REFERENCE STANDARDS

A. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2014.

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

C. 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 30 00 - Administrative Requirements, for submittal procedures.

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

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.

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 MANUFACTURERS

A. Insulation: Any that meet the requirements of this section
   1. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 FOAM BOARD INSULATION MATERIALS

A. Extruded Polystyrene Board Insulation: Extruded polystyrene board; ASTM C578; with either natural skin or cut cell surfaces, and the following characteristics:
   1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
   2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
   3. R-value; 1 inch of material at 72 degrees F: 5, minimum.
   4. Board Edges: Square.
   5. Manufacturers:
      a. Dow Chemical Co: www.dow.com.
      b. Owens Corning Corporation; FOAMULAR Extruded Polystyrene (XPS) Insulation: www.ocbuildingspec.com.
      c. Kingspan Insulation LLC; GreenGuard XPS TYPE IV 25 PSI: www.trustgreenguard.com.
   6. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 BATT INSULATION MATERIALS

A. Where batt insulation is indicated, either glass fiber or mineral fiber batt insulation may be used, at Contractor's option.

B. Glass Fiber Batt Insulation: Flexible preformed batt or blanket, complying with ASTM C665; friction fit.
   1. Combustibility: Non-combustible, when tested in accordance with ASTM E136, except for facing, if any.

2.04 ACCESSORIES

A. Insulation Fasteners: Impaling clip of galvanized steel with washer retainer and clips, to be adhered to surface to receive insulation, length to suit insulation thickness and substrate, capable of securely and rigidly fastening insulation in place.

B. 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.

B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

3.02 BOARD INSTALLATION AT EXTERIOR WALLS

A. Apply manufacturer's recommended adhesive to back of boards:
   1. Full bed 1/8 inch thick.

B. Install boards horizontally on walls.

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

3.03 BOARD INSTALLATION AT CAVITY WALLS

A. Apply adhesive to back of boards:
   1. Three continuous beads per board length.
   2. Full bed 1/8 inch thick.

B. Install boards to fit snugly between wall ties.

C. Install boards horizontally on walls.

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

3.04 BATT INSTALLATION

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

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

C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.

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

E. Retain insulation batts in place with spindle fasteners at 12 inches on center.

3.05 PROTECTION

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

END OF SECTION

SECTION 07 21 19

FOAMED-IN-PLACE INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Foamed-in-place insulation.
   1. In exterior framed walls to fill voids not filled by batt insulation.
   2. In exterior wall crevices.
   3. At junctions of dissimilar wall and roof materials to achieve a continuous thermal and air seal.
   4. Perimeter of door and windows
   5. At perimeter of existing waffle slab and and existing pre-cast panels at:
      a. Second floor and and first floor roof perimeter
      b. Third floor and second floor roof perimeter
      c. Third floor roof perimeter

B. Framing Cavities and Joints: In addition to locations identified in 1.01A above provide foamed in place insulation where indicated on drawings.

1.02 REFERENCE STANDARDS

A. ASTM C1029 - Standard Specification for Spray-Applied Rigid Cellular Polyurethane Thermal Insulation; 2007.

B. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2014.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide product description, insulation properties, overcoat properties, and preparation requirements.

C. Manufacturer's Installation Instructions: Indicate special procedures, and perimeter conditions requiring special attention.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with not less than three years of documented experience.

B. Applicator Qualifications: Company specializing in performing work of the type specified, with minimum three years documented experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Foamed-In-Place Spray Insulation:
   1. Polymaster Insulating Foams, Inc; Product InsulThane Sealite: www.polymaster.com
   2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 MATERIALS

A. Foamed-In-Place Insulation: Flexible, open celled, water vapor permeable polyurethane foam; foamed on-site, using blowing agent of water or non-ozone-depleting gas.
   1. Regulatory Requirements: Conform to applicable code for flame and smoke limitations.
   2. R-Value: At 1 inch per ASTM C518, R=4.1
   3. Core Density - .5 pcf in accordance with ASTM C1622
   4. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/450, maximum, when tested in accordance with ASTM E84.

2.03 ACCESSORIES

A. Primer: As required by insulation manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify work within construction spaces or crevices is complete prior to insulation application.

B. Verify that surfaces are clean, dry, and free of matter that may inhibit insulation adhesion.

C. Ensure that CMU cores or spaces are free of mortar or other restrictions

3.02 PREPARATION

A. Mask and protect adjacent surfaces from over spray or dusting.

B. Apply primer in accordance with manufacturer's instructions.

3.03 APPLICATION

A. Install insulation in accordance with manufacturer's printed instructions.

B. Apply insulation by spray method, to a uniform monolithic density without voids.

C. Apply to a minimum cured thickness of 3 inch.

D. Where applied to voids and gaps assure space for expansion to avoid pressure on adjacent materials that may bind operable parts.

3.04 FIELD QUALITY CONTROL

A. Field inspections and tests will be performed by an independent testing agency under provisions of Section 01 40 00.

3.05 SCHEDULES

A. Provide Spray foam insulation at the following locations to provide thermal and air seal
   1. Perimeter of windows and doors
   2. Junction of pre-cast panels and floor and / or roof
   3. Perimeter of roof penetrations including vents, fans and skylights
   4. Exterior wall crevices

B. In addition to 3.05 above provide spray foam in all locations indicated on the drawings

END OF SECTION

SECTION 07 41 13
METAL ROOF PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Architectural roofing system of preformed steel panels

B. Fastening system.

C. Factory finishing.

D. Accessories and miscellaneous components.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Roof sheathing.

B. Section 07 42 13 - Metal Wall Panels: Preformed wall panels.

1.03 REFERENCE STANDARDS

A. ASCE 7 - Minimum Design Loads for Buildings and Other Structures; 2011.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2013.

C. ASTM D226/D226M - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing; 2009.

D. ASTM E1592 - Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference; 2005 (Reapproved 2012).

E. ASTM E1646 - Standard Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference; 1995 (Reapproved 2011).

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Storage and handling requirements and recommendations.
   2. Installation methods.
   3. Specimen warranty.

C. Shop Drawings: Include layouts of roof panels, details of edge and penetration conditions, spacing and type of connections, flashings, underlayments, and special conditions.
   1. Show work to be field-fabricated or field-assembled.

D. Selection Samples: For each roofing system specified, submit color chips representing manufacturer's full range of available colors and patterns.

E. Verification Samples: For each roofing system specified, submit samples of minimum size 12 inches square, representing actual roofing metal, thickness, profile, color, and texture.
   1. Include typical panel joint in sample.
   2. Include typical fastening detail.

F. Test Reports: Indicate compliance of metal roofing system to specified requirements.

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

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in the manufacture of roofing systems similar to those required for this project, with no less than 5 years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Provide strippable plastic protection on prefinished roofing panels for removal after installation.

B. Store roofing panels on project site as recommended by manufacturer to minimize damage to panels prior to installation.

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Finish Warranty: Provide manufacturer's special warranty covering failure of factory-applied exterior finish on metal roof panels and agreeing to repair or replace panels that show evidence of finish degradation, including significant fading, chalking, cracking, or peeling within specified warranty period of 5 year period from date of Substantial Completion.

C. Waterproofing Warranty: Provide manufacturer's warranty for weathertightness of roofing system, including agreement to repair or replace roofing that fails to keep out water within specified warranty period of 5 years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Roof Panels:
   1. Taylor Metal Products: MS 150..

B. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ARCHITECTURAL ROOF PANELS

A. Performance Requirements:
   1. Provide complete engineered system complying with specified requirements and capable of remaining weathertight while withstanding anticipated movement of substrate and thermally induced movement of roofing system.
   2. Wall/roof and soffit panels shall be by same manufacturer.

B. Architectural Metal Roofing: Provide complete engineered system complying with specified requirements and capable of remaining weathertight while withstanding anticipated movement of substrate and thermally induced movement of roofing system.

C. Metal Panels: Factory-formed panels with factory-applied finish.

D. Metal Roofing: 24 gage. Factory-formed panels with Forrest Green Kynar Paint System finish.
   1. Steel Panels:
      a. Zinc-coated steel conforming to ASTM A653/A653M; minimum G90 galvanizing.
      b. Steel Thickness: Minimum 24 gage (0.024 inch).
   2. Profile: Standing seam, with minimum 2.0 inch seam height; concealed fastener system for field seaming with special tool.
   3. Texture: Smooth.
   4. Length: Full length of roof slope, without lapped horizontal joints.
   5. Width: Maximum panel coverage of 16 inches.
   6. Mill-Finish Steel Panels: Treat with passivating chemical prior to shipment, to inhibit formation of corrosion.

2.03 ATTACHMENT SYSTEM

A. Concealed System: Provide manufacturer's standard stainless steel concealed anchor clips designed for specific roofing system and engineered to meet performance requirements, including anticipated thermal movement.

2.04 PANEL FINISH

A. Fluoropolymer Coating System: Manufacturer's standard multi-coat thermocured coating system, including minimum 70 percent fluoropolymer color topcoat with minimum total dry film thickness of 0.9 mil; color and gloss as selected from manufacturer's standards.

2.05 ACCESSORIES AND MISCELLANEOUS ITEMS

A. Miscellaneous Sheet Metal Items: Provide flashings, trim, moldings, closure strips, and caps of the same material, thickness, and finish as used for the roofing panels. Items completely concealed after installation may optionally be made of stainless steel.

B. Rib and Ridge Closures: Provide prefabricated, close-fitting components of steel with corrosion resistant finish, closed-cell synthetic rubber, neoprene, or PVC, or combination steel and closed-cell foam.

C. Sealants:
   1. Exposed Sealant: Elastomeric; silicone, polyurethane, or silyl-terminated polyether/polyurethane.
   2. Concealed Sealant: Non-curing butyl sealant or tape sealant.
   3. Seam Sealant: Factory-applied, non-skinning, non-drying type.

D. Underlayment: Self adhering high temperature;
   1. Manufacturer: Carlisle
   2. Product: WIP 300HT
   3. Substitutions: See Section 01 60 00 - Product Requirements.

2.06 FABRICATION

A. Panels: Fabricate panels and accessory items at factory, using manufacturer's standard processes as required to achieve specified appearance and performance requirements.

B. Joints: Factory-install captive gaskets, sealants, or separator strips at panel joints to provide weathertight seals, eliminate metal-to-metal contact, and minimize noise from panel movements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation of preformed metal roof panels until substrates have been properly prepared.

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

3.02 PREPARATION

A. Broom clean wood sheathing prior to installation of roofing system.

B. Coordinate roofing work with provisions for roof drainage, flashing, trim, penetrations, and other adjoining work to assure that the completed roof will be free of leaks.

C. Remove protective film from surface of roof panels immediately prior to installation. Strip film carefully, to avoid damage to prefinished surfaces.

D. Separate dissimilar metals by applying a bituminous coating, self-adhering rubberized asphalt sheet, or other permanent method approved by roof panel manufacturer.

E. Where metal will be in contact with wood or other absorbent material subject to wetting, seal joints with sealing compound and apply one coat of heavy-bodied bituminous paint.

3.03 INSTALLATION

A. Overall: Install roofing system in accordance with approved shop drawings and panel manufacturer's instructions and recommendations, as applicable to specific project conditions. Anchor all components of roofing system securely in place while allowing for thermal and structural movement.
   1. Install roofing system with concealed clips and fasteners, except as otherwise recommended by manufacturer for specific circumstances.
   2. Minimize field cutting of panels. Where field cutting is absolutely required, use methods that will not distort panel profiles. Use of torches for field cutting is absolutely prohibited.

B. Accessories: Install all components required for a complete roofing assembly, including flashings, trim, moldings, closure strips, caps, rib closures, ridge closures, and similar roof accessory items.

C. Underlayment: Install on roof deck before installing preformed metal roof panels. Lap over eaves at bottom and under ridge flashing at top in shingle fashion, overlapping horizontal joints a minimum of 2 inches and side and end laps a minimum of 4 inches.

D. Roof Panels: Install panels in strict accordance with manufacturer's instructions, minimizing transverse joints except at junction with penetrations.

3.04 CLEANING AND PROTECTION

A. Clean exposed sheet metal work at completion of installation. Remove grease and oil films, excess joint sealer, handling marks, and debris from installation, leaving the work clean and unmarked, free from dents, creases, waves, scratch marks, or other damage to the finish.

B. Do not permit storage of materials or roof traffic on installed roof panels. Provide temporary walkways or planks as necessary to avoid damage to completed work. Protect roofing until completion of project.

C. Touch-up, repair, or replace damaged roof panels or accessories before date of Substantial Completion.

3.05 PROTECTION

A. Touch-up, repair, or replace damaged roof panels or accessories before date of Substantial Completion.

END OF SECTION

SECTION 07 42 14

INSULATED METAL WALL PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Factory-assembled metal panel system for walls and soffits, with trim, related flashings and accessory components.

1.02 RELATED REQUIREMENTS

A. Section 05 40 00 - Cold-Formed Metal Framing: Panel support framing system.

B. Section 07 62 00 - Sheet Metal Flashing and Trim.

PART 2 PRODUCTS

2.01 PANEL SYSTEM

A. Metal Panel System: Factory-assembled metal panel system, with trim, related flashings and accessory components.
   1. Provide positive drainage to exterior for moisture entering or condensation occurring within panel system.
   2. Accommodate tolerances of building structural framing.

B. Performance Requirements:
   1. Thermal Performance: Provide thermal resistance through entire system; R-value of ____ deg F hr sq ft/Btu, minimum.
   2. Structural Performance: Design and size to withstand all dead loads and wind loads caused by positive and negative wind pressure acting normal to plane of panel.
      a. Verify structural performance in accordance with ASTM E330/E330M, using test pressure 1.5 times design wind pressure, with 10 seconds duration of maximum load.
   3. Movement: Accommodate the movement caused by the following without damage to system, components, or deterioration of seals:
      a. Normal movement between system components.
      b. Seasonal temperature cycling.
      c. Deflection of structural support framing,

2.02 PANELS AND TRIM

A. Wall Panels: Exterior and interior metal sheet skin, factory-assembled, with foamed in place insulation; exterior and interior sheet interlocking at edges, fitted with continuous gaskets.

END OF SECTION

SECTION 07 52 00

MODIFIED BITUMINOUS MEMBRANE ROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Modified bituminous roofing membrane, conventional application.

B. Insulation, flat and tapered.

C. Base flashings.

D. Roofing cant strips and accessories.

1.02 RELATED REQUIREMENTS

A. Section 07 72 00 - Roof Accessories: Prefabricated curb for mechanical equipment.

1.03 REFERENCE STANDARDS

A. ASTM D41/D41M - Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing; 2011.

B. ASTM D312 - Standard Specification for Asphalt Used in Roofing; 2000 (Reapproved 2006).

C. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2012)e1.

D. NRCA ML104 - The NRCA Roofing and Waterproofing Manual; National Roofing Contractors Association; Fifth Edition, with interim updates.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with installation of associated flashings and counterflashings installed by other sections.

B. Coordinate with removal of existing roof curbs, HVAC equipment and installation of new roof curbs and new HVAC equipment.

C. Preinstallation Meeting: Convene one week before starting work of this section.

1. Review preparation and installation procedures as well as coordination and scheduling required with regard to related work installed by other disciplines.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's catalog data for membrane and bitumen materials, base flashing materials, insulation, vapor retarder, and surfacing.

C. Manufacturer's Installation Instructions: Indicate special procedures.

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

1.06 QUALITY ASSURANCE

A. Perform work in accordance with NRCA Roofing and Waterproofing Manual and manufacturer's instructions.

B. Manufacturer Qualifications: Manufacturer shall be same manufacturer as for the existing/original roof.

C. Installer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience, and approved by manufacturer.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in manufacturer's original containers, dry, undamaged, with seals and labels intact.

B. Store products in weather protected environment, clear of ground and moisture; ballast materials may be stored outdoors.

1.08 FIELD CONDITIONS

A. Do not apply roofing membrane when environmental conditions are outside the ranges recommended by manufacturer.

B. Do not apply roofing membrane during unsuitable weather.

C. Do not apply roofing membrane when ambient temperature is below 40 degrees F.

D. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.

E. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.

1.09 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a two year period after Date of Substantial Completion.

C. Maintain original roof warranty.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Membrane Materials: Match adjacent existing roof membrane materials
   1. Substitutions: See Section 01 60 00 - Product Requirements.

B. Insulation: Polyisocyanurate insulation
   1. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ROOFING - CONVENTIONAL APPLICATION

A. Modified Bituminous Roofing: 4 ply system with mineral cap sheet, with vapor retarder and insulation. Provide high density re-cover board over insulation.

B. Roofing Assembly Requirements:
   1. External Fire Exposure Classification: ASTM E108 Class A, UL listed.
   2. Insulation Thermal Value (R), minimum: Match existing thickness or 3 inches minimum; provide insulation of thickness required.

C. Acceptable Insulation Types - Tapered Application: Any of the types specified.
   1. Tapered polyisocyanurate, perlite, or extruded polystyrene board.

2.03 BITUMINOUS MATERIALS

A. Bitumen: Asphalt, ASTM D312 Type IV; for adhering insulation, use Type III.

B. Primer: ASTM D41/D41M, asphalt type.

C. Roof Cement: ASTM D4586/D4586M, Type II.

2.04 ACCESSORIES

A. Cant and Edge Strips: Asphalt-impregnated wood fiberboard, compatible with roofing materials; cants formed to 45 degree angle.

B. Pipe Flashing: Provide pre-molded pipe flashings for electrical conduits

C. Sealants: As recommended by membrane manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and site conditions are ready to receive work.

B. Verify deck is supported and secure.

C. Verify deck is clean and smooth, flat, free of depressions, waves, or projections, properly sloped and suitable for installation of roof system.

D. Verify deck surfaces are dry and free of snow or ice.

E. Verify that roof openings, curbs, and penetrations through roof are solidly set, and cant strips are in place.

3.02 CONCRETE DECK PREPARATION

A. Fill surface honeycomb and variations with latex filler.

B. Confirm dry deck by moisture meter with 12 percent moisture maximum.

3.03 INSULATION INSTALLATION - CONVENTIONAL APPLICATION

A. Place tapered insulation to the required slope pattern in accordance with manufacturer's instructions.

B. Lay boards with edges in moderate contact without forcing. Cut insulation to fit neatly to perimeter blocking and around penetrations through roof.

C. Do not apply more insulation than can be covered with membrane in same day.

3.04 MEMBRANE APPLICATION

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

B. Apply membrane; lap and seal edges and ends permanently waterproof.

C. Apply smooth, free from air pockets, wrinkles, fish-mouths, or tears. Ensure full bond of membrane to substrate.

D. At end of day's operation, install waterproof cut-off. Remove cut-off before resuming roofing.

E. At intersections with vertical surfaces:
   1. Extend membrane over cant strips and up a minimum of 8 inches onto vertical surfaces.
   2. Apply flexible flashing over membrane.

F. Around roof penetrations, mop in and seal flanges and flashings with flexible flashing.

G. Coordinate installation of roof drains and sumps and related flashings.

3.05 CLEANING

A. Remove bituminous markings from finished surfaces.

B. In areas where finished surfaces are soiled by bitumen or other source of soiling caused by work of this section, consult manufacturer of surfaces for cleaning advice and conform to their documented instructions.

C. Repair or replace defaced or damaged finishes caused by work of this section.

3.06 PROTECTION

A. Protect installed roofing and flashings from construction operations.

B. Where traffic must continue over finished roof membrane, protect surfaces using durable materials.

END OF SECTION

SECTION 07 62 00
SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fabricated sheet metal items, including flashings and counterflashings.

B. Sealants for joints within sheet metal fabrications.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Field fabricated roof curbs and base flashings at sill

1.03 REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; American Architectural Manufacturers Association; 2012.

B. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels; 2013.

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

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

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

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

G. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2012)e1.

H. SMACNA (ASMM) - Architectural Sheet Metal Manual; Sheet Metal and Air Conditioning Contractors' National Association; 2012.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

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

1.06 QUALITY ASSURANCE

A. Perform work in accordance with SMACNA 1793 and CDA A4050 requirements and standard details, except as otherwise indicated.

1.07 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. Pre-Finished Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 0.02 inch thick base metal, shop pre-coated with PVDF coating.
   1. PVDF (Polyvinylidene Fluoride) Coating: Superior Performance Organic Finish, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system.
   2. Color: As selected by Architect from manufacturer's standard colors.

B. Aluminum: ASTM B209 (ASTM B209M); 0.032 inch thick; anodized finish of color as selected.

1. Clear Anodized Finish: AAMA 611 AA-M12C22A41 Class I clear anodic coating not less than 0.7 mils thick.

2.02 ACCESSORIES

A. Fasteners: Same material and finish as flashing metal, with soft neoprene washers.

B. Protective Backing Paint: Zinc molybdate alkyd.

C. Sealant to be Concealed in Completed Work: Non-curing butyl sealant.

D. Sealant to be Exposed in Completed Work: ASTM C920; elastomeric sealant, 100 percent silicone with minimum movement capability of plus/minus 25 percent and recommended by manufacturer for substrates to be sealed; clear.

E. Butyl Tape: 1/2 wide

F. Plastic Cement: ASTM D4586, 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 over lap seams 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.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify window openings, curbs, are solidly set, reglets in place, and nailing strips located.

B. 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 with protective backing paint to a minimum dry film thickness of 15 mil.

3.03 INSTALLATION

A. Secure flashings in place using concealed fasteners. Use exposed fasteners only where permitted.

B. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.

C. Seal metal joints watertight.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for field inspection requirements.

B. Inspection will involve surveillance of work during installation to ascertain compliance with specified requirements.

3.05 SCHEDULE

A. Flashings at storefront or curtain all window system and all flashings exposed to view from street: Aluminum

B. Flashings at roof curbs: Pre-finished galvanized metal

END OF SECTION

SECTION 07 72 00
ROOF ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Manufactured curbs

1.02 RELATED REQUIREMENTS

A. Section 07 52 00 Modified Bituminous Roofing: Curbs to be "roofed in"

B. Section 23 05 49 Vibration and Seismic Controls for HVAC: Seismic calculations and shop drawings to be submitted with roof curbs

C. Section 23 62 13 Packaged Air-Cooled Refrigerant Compressors and Condenser Units: Units to be set on roof curbs

D. Section 23 74 13 Package Roof Top Air Conditioning Units: Units to be set on roof curbs

1.03 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2013.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used.
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.
   4. Maintenance requirements.

C. Shop Drawings: For penetrating and non-penetrating rooftop supports, submit detailed layout developed for this project, with design calculations for loadings and spacings

D. Design components and develop structural calculations and provide shop drawings work under direct supervision of a Professional Structural Engineer experienced in design of this Work.
   1. Design Engineer Qualifications: Licensed in the State in which the Project is located.(State of Oregon)
   2. Conform to design calculations for attachment for seismic restraint as required for acquiring permits.
   3. Provide calculations and shop drawings. Submit to the City of Salem as a deferred submittal.
   4. Provide building permit for roof curbs

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store products under cover and elevated above grade.

PART 2 PRODUCTS

2.01 MANUFACTURED CURBS

A. Manufactured Curbs, Equipment Rails, and Other Roof Mounting Assemblies:
   1. Thybar Corporation: 1-800-666-2872
      a. Substitutions: See Section 01 60 00 - Product Requirements.

B. Manufactured Curbs: Factory-assembled hollow sheet metal construction with fully mitered and welded corners, integral counterflashing, internal reinforcing, and top side and edges formed to shed water. Product: TC-5 by Thybar Corporation
   1. Sheet Metal: Hot-dip zinc coated steel sheet complying with ASTM A653/A653M, SS Grade 33 ; G90 coating designation;.0635 inch thick.

2. Manufacture curb bottom and mounting flanges for installation directly on roof deck, not on insulation; match slope and configuration of roof deck.
3. Provide the layouts and configurations shown on the drawings.
4. Provide Pressure treated wood at top rail
5. Provide gasket
6. Height about Finished Roof Surface 8 inches minimum
7. Height about Roof Deck: 14 inches minimum

C. Manufactured Vibration Isolation Curbs: Factory-assembled hollow sheet metal construction with fully mitered and welded corners, integral counterflashing, internal reinforcing, and top side and edges formed to shed water. Product: Vibro-Curb III by Thybar Corporation
1. Sheet Metal: Hot-dip zinc coated steel sheet complying with ASTM A653/A653M, SS Grade 33 ; G90 coating designation;.0785 inch thick.
2. Manufacture curb base and mounting flanges for installation directly on roof deck, not on insulation; match slope and configuration of roof deck.
3. Provide the layouts and configurations shown on the drawings.
4. Provide Pressure treated wood at top rail with 9 inch continuous rubber counter flashing
5. Provide 3 inch mounting springs
6. Height about Roof Deck: 24 inches minimum

D. Equipment Rails: Two-sided curbs in straight lengths, for insulated roof decks with a 3 inch cant and step to match deck insulation. Provide top horizontal for equipment mounting. Product: TEMS 1 by Thybar Corporation
1. Provide preservative treated wood nailers along top of rails.
2. Height Above Finished Roof Surface: 15 inches, minimum.
3. Height Above Roof Deck: 18 inches, minimum.

E. Duct / Damper Mounting Support: Vertical posts, minimum 1 5/8 Minimum inches square unless otherwise indicated. Manufacturer: Unistrut
1. Material: Stainless Steel
2. Provide sliding channel welded along top edge with adjustable height steel bracket, manufactured to fit item supported.
3. Provide one 90 degree gusset per each vertical post.
4. Height Above Roof Deck: 14 inches, minimum.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

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

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions, in manner that maintains roofing weather integrity.

3.04 CLEANING

A. Clean installed work to like-new condition.

3.05 PROTECTION

A. Protect installed products until completion of project.

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

3.06 SCHEDULE

A. Duct Supports: TEMS 1 with Unistrut support

B. Relief Fans: Vibro-Curb III

END OF SECTION

SECTION 07 84 00
FIRESTOPPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Firestopping systems.

B. Firestopping of all joints and penetrations in fire resistance rated and smoke resistant assemblies, whether indicated on drawings or not, and other openings indicated.

1.02 RELATED REQUIREMENTS

A. Section 09 21 16 - Gypsum Board Assemblies: Gypsum wallboard fireproofing.

1.03 REFERENCE STANDARDS

A. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2014.

B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2013a.

C. ASTM E1966 - Standard Test Method for Fire Resistive Joint Systems; 2007 (Reapproved 2011).

D. ASTM E2174 - Standard Practice for On-Site Inspection of Installed Firestops; 2014.

E. ASTM E2307 - Standard Test Method for Determining Fire Resistance of Perimeter Fire Barriers Using Intermediate-Scale, Multi-story Test Apparatus; 2010.

F. ASTM E2837 - Standard Test Method for Determining the Fire Resistance of Continuity Head-of-Wall Joint Systems Installed Between Rated Wall Assemblies and Nonrated Horizontal Assemblies; 2013.

G. ITS (DIR) - Directory of Listed Products; Intertek Testing Services NA, Inc.; current edition.

H. FM 4991 - Approval Standard for Firestop Contractors; Factory Mutual Research Corporation; 2013.

I. FM P7825 - Approval Guide; Factory Mutual Research Corporation; current edition.

J. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems; Underwriters Laboratories Inc.; 2004.

K. UL (FRD) - Fire Resistance Directory; Underwriters Laboratories Inc.; current edition.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.

C. Product Data: Provide data on product characteristics, performance ratings, and limitations.

D. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.05 QUALITY ASSURANCE

A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated.
   1. Listing in the current-year classification or certification books of UL, FM, or ITS (Warnock Hersey) will be considered as constituting an acceptable test report.
   2. Valid evaluation report published by ICC Evaluation Service, Inc. (ICC-ES) at www.icc-es.org will be considered as constituting an acceptable test report.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Installer Qualifications: Company specializing in performing the work of this section and:
   1. With minimum 3 years documented experience installing work of this type.

1.06 MOCK-UP

A. Install one firestopping assembly representative of each fire rating design required on project.
   1. Where one design may be used for different penetrating items or in different wall constructions, install one assembly for each different combination.
   2. Where firestopping is intended to fill a linear opening, install minimum of 1 linear ft.

B. Obtain approval of authority having jurisdiction before proceeding.

C. If accepted, mock-up will represent minimum standard for the Work.

D. If accepted, mock-up may remain as part of the Work. Remove and replace mock-ups not accepted.

1.07 FIELD CONDITIONS

PART 2 PRODUCTS

2.01 FIRESTOPPING - GENERAL REQUIREMENTS

A. Manufacturers:
   1. A/D Fire Protection Systems Inc: www.adfire.com.
   2. 3M Fire Protection Products: www.3m.com/firestop.
   3. Hilti, Inc: www.us.hilti.com.
   4. Nelson FireStop Products: www.nelsonfirestop.com.
   5. Specified Technologies, Inc: www.stifirestop.com.
   6. Substitutions: See Section 01 60 00 - Product Requirements.

B. Firestopping: Any material meeting requirements.

C. Materials: Use any material meeting requirements.

D. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Type required for tested assembly design.

E. Fire Ratings: See Drawings for required systems and ratings.

2.02 FIRESTOPPING ASSEMBLY REQUIREMENTS

A. Perimeter Fire Containment Firestopping: Use any system that has been tested according to ASTM E2307 to have fire resistance F Rating equal to required fire rating of the floor assembly.

B. Head-of-Wall Firestopping at Joints Between Non-Rated Floor and Fire-Rated Wall: Use any system that has been tested according to ASTM E2837 to have fire resistance F Rating equal to required fire rating of floor or wall, whichever is greater.

C. Through Penetration Firestopping: Use any system that has been tested according to ASTM E814 to have fire resistance F Rating equal to required fire rating of penetrated assembly.

2.03 FIRESTOPPING FOR FLOOR-TO-FLOOR, WALL-TO-FLOOR, AND WALL-TO-WALL JOINTS

A. Gypsum Board Walls:
   1. Wall to Wall and Wall to Ceiling Joints:
      a. 1 Hour Construction: UL System WW-D-0067; Hilti CP 606 Flexible Firestop Sealant.

2.04 FIRESTOPPING PENETRATIONS THROUGH CONCRETE AND CONCRETE MASONRY CONSTRUCTION

A. Penetrations Through Walls By:
   1. Uninsulated Metallic Pipe, Conduit, and Tubing:
      a. 1 Hour Construction: UL System W-J-1067; Hilti FS-ONE MAX Intumescent Firestop Sealant.
   2. Insulated Pipes:
      a. 1 Hour Construction: UL System C-AJ-5091; Hilti FS-ONE MAX Intumescent Firestop Sealant.
   3. HVAC Ducts, Uninsulated:
      a. 1 or 2 Hour Construction: UL System W-J-7109; Hilti FS-ONE MAX Intumescent Firestop Sealant or CP 606 Flexible Firestop Sealant.

4. HVAC Ducts, Insulated:
    a. 1 or 2 Hour Construction: UL System W-J-7112; Hilti FS-ONE MAX Intumescent Firestop Sealant.

2.05 FIRESTOPPING PENETRATIONS THROUGH GYPSUM BOARD WALLS

A. Blank Openings:
    1. 1 Hour Construction: UL System W-L-3334; Hilti CP 653 Speed Sleeve.

B. Penetrations By:
    1. Multiple Penetrations in Large Openings:
        a. 1 Hour Construction: UL System W-L-1408; Hilti FS-ONE MAX Intumescent Firestop Sealant.
    2. Uninsulated Metallic Pipe, Conduit, and Tubing:
        a. 1 Hour Construction: UL System W-L-1164; Hilti FS-ONE MAX Intumescent Firestop Sealant.
    3. Uninsulated Non-Metallic Pipe, Conduit, and Tubing:
        a. 1 Hour Construction: UL System W-L-2128; Hilti FS-ONE MAX Intumescent Firestop Sealant.
    4. Insulated Pipes:
        a. 1 Hour Construction: UL System W-L-5028; Hilti FS-ONE MAX Intumescent Firestop Sealant.
    5. HVAC Ducts, Insulated or uninsulated:
        a. 1 Hour Construction: UL System W-L-7156; Hilti FS-ONE MAX Intumescent Firestop Sealant.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify openings are ready to receive the work of this section.

3.02 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter that could adversely affect bond of firestopping material.

B. Remove incompatible materials that could adversely affect bond.

C. Install backing materials to arrest liquid material leakage.

3.03 INSTALLATION

A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.

B. Do not cover installed firestopping until inspected by Owner's Independent Testing Agency.

C. Do not cover installed firestopping until inspected by authority having jurisdiction.

D. Install labeling required by code.

3.04 FIELD QUALITY CONTROL

A. Independent Testing Agency: Inspection agency employed and paid by Owner, will examine penetration firestopping in accordance with ASTM E2174, “Standard Practice for On-Site Inspection of Installed Fire Stops and ASTM E2393, “Standard Practice for On-Site Inspection of Installed Fire Stop Joint Systems.

B. Repair or replace penetration firestopping and joints at locations where inspection results indicate firestopping or joints do not meet specified requirements.

3.05 CLEANING

A. Clean adjacent surfaces of firestopping materials.

3.06 PROTECTION

A. Protect adjacent surfaces from damage by material installation.

END OF SECTION

SECTION 07 90 05

JOINT SEALERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sealants and joint backing.

B. Precompressed foam sealers.

1.02 RELATED SECTIONS

A. Section 07 84 00 - Firestopping: Firestopping sealants.

B. Section 08 43 13 - Aluminum Framed Storefront: Sealants at perimeter of storefront windows

C. Section 08 63 00 - Metal-Framed Skylights: Structural and weatherseal sealants and accessories.

D. Section 08 80 00 - Glazing: Glazing sealants and accessories.

E. Section 09 21 16 - Gypsum Board Assemblies: Acoustic sealant.

1.03 REFERENCE STANDARDS

A. ASTM C834 - Standard Specification for Latex Sealants; 2014.

B. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications; 2012.

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

D. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2013.

E. ASTM D1056 - Standard Specification for Flexible Cellular Materials--Sponge or Expanded Rubber; 2014.

F. ASTM D1667 - Standard Specification for Flexible Cellular Materials--Poly(Vinyl Chloride) Foam (Closed-Cell); 2005 (Reapproved 2011).

G. ASTM D2628 - Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for concrete Pavements; 1991 (Reapproved 2011).

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data indicating sealant chemical characteristics.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

B. Applicator Qualifications: Company specializing in performing the work of this section with minimum three years documented experience and approved by manufacturer.

1.06 MOCK-UP

A. Provide mock-up of sealant joints in conjunction with window, wall, and doors under provisions of Section 01 40 00.

B. Construct mock-up with specified sealant types and with other components noted.

C. Locate where directed.

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

1.07 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

1.08 COORDINATION

A. Coordinate the work with all sections referencing this section.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Sealants:
   1. Bostik Inc: www.bostik-us.com.
   2. GE Plastics: www.geplastics.com.
   3. Pecora Corporation: www.pecora.com.
   4. BASF Construction Chemicals-Building Systems: www.chemrex.com.
   5. Down Corning .www.dowcorning.com
   6. Sika Corporation: www.sikaconstruction.com
   7. Substitutions: See Section 01 60 00 - Product Requirements.
   8. Pecora Corporation: www.pecora.com.
   9. BASF Construction Chemicals-Building Systems: www.chemrex.com.
   10. Substitutions: See Section 01 60 00 - Product Requirements.
   11. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 SEALANTS

A. Type A - Silicone Building Sealant: Type S; ASTM C 920, Grade NS, Class 100/50, Uses T,NT M, G, A and O; single component.
   1. Color: Standard and Custom colors matching adjacent surfaces.
   2. Product: 790 manufactured by Dow Corning.
   3. Applications: Use for:
      a. Control, expansion, and soft joints in masonry.
      b. Joints between concrete and other materials.
      c. Joints between metal frames and other materials.
      d. General Building Sealant.
      e. Other exterior joints for which no other sealant is indicated.

B. Type B - Silicone Weatherproofing Sealant: Type S; ASTM C 920, Grade NS, Class 50, Uses NT M, G, and A; single component.
   1. Color: Standard colors matching finished surfaces.
   2. Product: 791 manufactured by Dow Corning.

C. Type C - Exterior Metal Lap Joint Sealant: Butyl Sealant nondrying, nonskinning, noncuring.
   1. Product: BC-158 manufactured by Pecora.
   2. Applications: Use for:
      a. Concealed sealant bead in sheet metal work.
      b. Concealed sealant bead in siding overlaps.

D. Type D - General Purpose Interior Sealant: Acrylic emulsion latex; ASTM C834, Type OP, Grade NF single component, paintable.
   1. Color: Match adjacent finished surfaces. Provide custom color.
   2. Product: AC-20 manufactured by Pecora.
   3. Applications: Use for:
      a. Interior wall and ceiling control joints.
      b. Interior joints between door and window frames and wall surfaces.
      c. Other interior joints for which no other type of sealant is indicated.

E. Type E - Bathtub/Tile Sealant: Mildew Resistant silicone; ASTM C 920, Uses I, M and A; single component, mildew resistant. Provide custom color to match adjacent surface
   1. Product: 786 manufactured by Dow Corning.
   2. Applications: Use for:
      a. Joints between plumbing fixtures and floor and wall surfaces.
      b. Joints between kitchen and bath countertops and wall surfaces.

F. Type F - Acoustical / Fire Rated Sealant: Latex sealant; ASTM C 834-86, Grade NS, Class 12-1/2, Uses M and A; single component, solvent release curing, non-skinning.
   1. Product: AC-20 FTR manufactured by Pecora.

2. Applications: Use for concealed locations only:
    a. Sealant bead between top stud runner and structure and between bottom stud track and floor.

2.03 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 D 1667, closed cell PVC; 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. Perform acoustical sealant application work in accordance with ASTM C919.

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.
    4. Minimum depth: 1/4 inch
    5. Maximum depth 1/2 inch

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. Dry tool joints concave.

I. Precompressed Foam Sealant: Do not stretch; avoid joints except at corners, ends, and intersections; install with face 1/4 to 1/2 inch below adjoining surface.

J. Compression Gaskets: Avoid joints except at ends, corners, and intersections; seal all joints with adhesive; install with face 1/4 to 1/2 inch below adjoining surface.

3.04 CLEANING

A. Clean adjacent soiled surfaces.

3.05 PROTECTION

A. Protect sealants until cured.

3.06 SCHEDULE

A. As specified in the section and as specified in other sections and as indicated on the drawings. Seal as follows:
   1. Exterior Joints between dissimilar materials
   2. Control and Expansion Joint concrete flat work:
      a. Fill all exposed saw cut joints, tooled joints in stained concrete shall remain unfilled
   3. Exterior Wall Seismic Movement Joints.
   4. Exterior Wall Expansion Joints.
   5. Lap Joints in Exterior Sheet Metal Work.
   6. Butt Joints in Exterior Metal Work and Siding.
   7. Joints Between Exterior and Adjacent Work
   8. Under Exterior Door Thresholds:
   9. Sealant under exterior steel stud track

END OF SECTION

SECTION 08 12 13
HOLLOW METAL FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Non-fire-rated steel frames for non-steel doors.

B. Fire-rated steel door frames for non-steel doors.

C. Frames for non-steel sound-rated doors.

D. Interior glazed light frames.

1.02 RELATED REQUIREMENTS

A. Section 08 71 00 - Door Hardware: Hardware, silencers, and weatherstripping.

B. Section 08 80 00 - Glazing: Glass for borrowed lites.

C. Section 09 90 00 - Painting and Coating: Field painting of frames.

1.03 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

B. ANSI/SDI A250.3 - Test Procedure and Acceptance Criteria for Factory Applied Finish Coatings for Steel Doors and Frames; 2007 (R2011).

C. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2014.

D. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2011.

E. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength, Low Alloy, and High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable; 2013.

F. BHMA A156.115 - American National Standard for Hardware Preparation in Steel Doors and Steel Frames; 2014. (ANSI/BHMA A156.115)

G. ICC A117.1 - Accessible and Usable Buildings and Facilities; International Code Council; 2009 (ANSI).

H. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2013.

I. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 30 00 - 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 grade standard.

C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and identifying location of different finishes, if any.

D. Samples: Submit one sample of frame metal, 2 x 2 inches in size showing factory finishes, colors, and surface textures.

E. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.

1.05 DELIVERY, STORAGE, AND HANDLING

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Steel Frames with Applied Casings, Prefinished:

1. Timely Industries, Inc (singles and pairs); CK Series, kerfed with seal, 18 gage, 0.042 inch: www.timelyframes.com.
2. Timely Industries, Inc (singles and pairs); S Series, 20 gage, 0.032 inch: www.timelyframes.com.
3. Timely Industries, Inc (glazed frames); C Series, 18 gage, 0.042 inch: www.timelyframes.com.
4. Provide fire rated frames as indicated
5.

2.02 STEEL DOOR FRAMES - GENERAL REQUIREMENTS

A. Refer to Door and Frame Schedule on the drawings and per the door schedule appended to the specifications for frame sizes, fire ratings, sound ratings, finishing, door hardware to be installed, and other variations, if any.

B. Door Frame Type: Provide steel door frames with applied casings, prefinished.

C. Accessibility: Comply with ICC A117.1 and ADA Standards.

D. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with all the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

E. Hardware Preparation: In accordance with BHMA A156.115, with reinforcement welded in place, in addition to other requirements specified.

F. Transom Bars: Fixed, of profile same as jamb and head.

G. Frames for Interior Glazing or Borrowed Lights: Construction and face dimensions to match door frames, and as indicated on drawings.

2.03 STEEL DOOR FRAMES WITH APPLIED CASINGS

A. Frame Type: Knockdown, slip-on drywall frames; separate jambs and head with separate snap-on casings both sides; factory-applied finish on exposed surfaces.
   1. Frame Material: Cold-rolled steel complying with ASTM A1008/A1008M.
   2. Casing Material: Formed steel.
   3. Casing Profile: As scheduled.
   4. Finish: Factory-applied baked enamel finish, or electrostatically applied water-based paint.
      a. Color: As selected from manufacturer's standard colors.

B. Interior Door Frames, Fire-Rated: 18 gage, 0.042 inch, minimum frame steel thickness, with smoke gaskets.
   1. Fire Rating: As indicated on Door and Frame Schedule, tested in accordance with UL 10C ("positive pressure").
      a. Provide units listed and labeled by testing agency acceptable to authority having jurisdiction.
      b. Attach fire rating label to each fire rated unit.

C. Sound-Rated Door Frames: 18 gage, 0.042 inch, with sound gasketing at jambs and head and adjustable door bottom device.
   1. Sound Rating: Tested with the door to achieve the rating specified for the door opening.

2.04 ACCESSORY MATERIALS

A. Silencers: Resilient rubber, fitted into drilled hole; 3 on strike side of single door, 3 on center mullion of pairs, and 2 on head of pairs without center mullions.

B. Grout for Frames: Portland cement grout of maximum 4-inch slump for hand troweling; thinner pumpable grout is prohibited.

C. Gaskets: Provide Timely T-46 gasket for sound rated doors.

2.05 FINISH MATERIALS

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.
   1. Color: To be selected by Architect from manufacturer's standard range.

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 frames in accordance with manufacturer's instructions and recommendations and as follows.

B. Install prefinished frames after painting and wall finishes are complete.

C. Install in accordance with the requirements of the specified door grade standard.

D. Install fire rated units in accordance with NFPA 80.

E. Coordinate frame anchor placement with wall construction.

F. Coordinate installation of glazing.

G. Coordinate installation of hardware.

H. Touch up damaged factory finishes.

3.03 TOLERANCES

A. Clearances Between Door and Frame: As specified in ANSI/SDI A250.8 (SDI-100).

B. Maximum Diagonal Distortion: 1/16 inch measured with straight edges, crossed corner to corner.

3.04 SCHEDULE

A. Refer to Door and Frame Schedule as appended to the specifications.

END OF SECTION

SECTION 08 14 16
FLUSH WOOD DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Flush wood doors; flush and flush glazed configuration; fire rated, non-rated, and acoustical.

1.02 RELATED REQUIREMENTS

A. Section 08 12 13 - Hollow Metal Frames.

B. Section 08 71 00 - Door Hardware.

C. Section 08 80 00 - Glazing.

1.03 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; current edition.

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

C. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009.

D. AWI (QCP) - Quality Certification Program, www.awiqcp.org; current edition at www.awiqcp.org.

E. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.

F. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2013.

G. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association; 2012.

H. UL 10B - Standard for Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

I. WDMA I.S. 1A - Interior Architectural Wood Flush Doors; Window and Door Manufacturers Association; 2013. (ANSI/WDMA I.S. 1A)

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.

C. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and other details.

D. Specimen warranty.

E. Test Reports: Show compliance with specified requirements for the following:
   1. Sound-retardant doors and frames; sealed panel tests are not acceptable.

F. Samples: Submit two samples of door construction, 12 by12 inch in size cut from top corner of door.

G. Samples: Submit two samples of door veneer, 12 by12 inch in size illustrating wood grain, stain color, and sheen.

H. Manufacturer's Installation Instructions: Indicate special installation instructions.

I. Warranty, executed in Owner's name.

1.05 QUALITY ASSURANCE

A. Quality Certification: Provide AWI (QCP) inspection report and quality certification of completed work.
   1. Provide labels or certificates indicating that the work complies with requirements of AWI/AWMAC/WI (AWS) grade or grades specified.
   2. This project has been registered as AWI (QCP) project number _____.
   3. Prior to delivery to the site provide shop drawings with certification labels.
   4. Provide labels on each product when required by certification program.

5. Upon completion of installation provide certificate certifying that the installation and products meet the specified requirements.
6. Arrange and pay for inspections required for certification.
7. Replace, repair, or rework all work for which certification is refused.

B. Installed Fire Rated Door Assembly: Conform to NFPA 80 for fire rated class as indicated.

1.06 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.

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Interior Doors: Provide manufacturer's warranty for the life of the installation.

C. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Wood Veneer Faced Doors:
1. Eggers Industries: www.eggersindustries.com.
2. Marshfield DoorSystems, Inc: www.marshfielddoors.com.
3. Oregon Door; Architectural Series: www.oregondoor.com.
4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 DOORS AND PANELS

A. All Doors: See drawings for locations and additional requirements.
1. Quality Level: Custom Grade, Extra 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 all locations.
2. Fire Rated Doors: Tested to ratings indicated on drawings and in the door schedule in accordance with NFPA 252 or UL 10B - Negative (Neutral) Pressure; Underwriters Laboratories Inc. (UL) or Intertek/Warnock Hersey (WHI) labeled without any visible seals when door is open.

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.

B. Fire Rated Doors: Mineral core type, with fire resistant composite core (FD), plies and faces as indicated above; with core blocking as required to provide adequate anchorage of hardware without through-bolting.

C. Sound Resistant Doors: Non combustible, asbestos free, urea-free mineral fire core.

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 book match between leaves of veneer, running match of spliced veneer leaves assembled on door or panel face.

2.05 ACCESSORIES

A. Glazed Openings:

1. Fire-Protection-Rated Glass: Safety Certification, 16 CFR 1201, Category II.

B. Glazing Stops: Wood, of same species as door facing, butted 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:

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.

E. Provide edge clearances in accordance with the quality standard specified.

2.07 FACTORY FINISHING - WOOD VENEER DOORS

A. Finish work in accordance with WDMA I.S. 1A for Grade specified and as follows:
   1. Transparent:
      a. System - TR-2, Catalyzed Lacquer.
      b. Stain: As selected by Architect.
      c. Sheen: Flat.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. 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. Field-Finished Doors: Trimming to fit is acceptable.
   1. Adjust width of non-rated doors by cutting equally on both jamb edges.
   2. Trim maximum of 1/2 inch off bottom edges.
   3. Trim fire-rated doors in strict compliance with fire rating limitations.

D. Use machine tools to cut or drill for hardware.

E. Coordinate installation of doors with installation of frames and hardware.

F. Coordinate installation of glazing.

G. Install door louvers plumb and level.

3.03 TOLERANCES

A. Conform to specified quality standard for fit and clearance tolerances.

B. Conform to specified quality standard for telegraphing, warp, and squareness.

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 and Frame Schedule appended to the specifications.

END OF SECTION

SECTION 08 33 13
COILING COUNTER DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Non-fire-rated coiling counter doors and operating hardware.

1.02 RELATED REQUIREMENTS

A. Section 06 41 00 Architectural Casework: Coiling counter door coordination

B. Section 09 21 16 - Gypsum Board Assemblies: Rough openings.

1.03 REFERENCE STANDARDS

A. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.

B. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric]; 2013.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit manufacturer's standard literature showing materials and details of construction and finish. Include data on electrical operation.

C. Shop Drawings: Indicate rough and actual opening dimensions, anchorage methods, hardware locations, and installation details.

D. Manufacturer's Instructions: Indicate installation sequence and installation, adjustment, and alignment procedures.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Coiling Counter Doors:
   1. Overhead Door Company: Series 655.
   2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 COILING COUNTER DOORS

A. Coiling Counter Doors, Non-Fire-Rated: Aluminum slat curtain.
   1. Mounting: Exterior face mounted.
   2. Nominal Slat Size: 1-1/4 inches wide.
   3. Slat Profile: Flat, perforated.
   4. Finish: Anodized.
   5. Guides: Formed track; same material and finish unless otherwise indicated.
   6. Hood: Manufacturer's standard.
   7. Operation: Manual hand chain lift operation.

2.03 MATERIALS

A. Curtain Construction: Interlocking, single thickness slats.
   1. Slat Ends: Alternate slats fitted with end locks to act as wearing surface in guides and to prevent lateral movement.
   2. Curtain Bottom: Fitted with angles to provide reinforcement and positive contact in closed position.
   3. Aluminum Slats: ASTM B221 (ASTM B221M), aluminum alloy Type 6063; minimum thickness 0.05 inch.

B. Guide Construction: Continuous, of profile to retain door in place, with mounting brackets of same metal.
   1. Aluminum Guides: Extruded aluminum channel, with wool pile runners along inside.

C. Hood Enclosure: Internally reinforced to maintain rigidity and shape.

D. Lock Cylinders: Specified in Section 08 71 00.

E. Latching: Inside mounted, sliding deadbolt.

F. Roller Shaft Counterbalance: Steel pipe and torsion steel spring system, capable of producing torque sufficient to ensure smooth operation of curtain from any position and capable of holding position at mid-travel; with adjustable spring tension; requiring 25 lb nominal force to operate.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that opening sizes, tolerances and conditions are acceptable.

3.02 INSTALLATION

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

B. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.

C. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.

D. Fit and align assembly including hardware; level and plumb, to provide smooth operation.

3.03 TOLERANCES

A. Maintain dimensional tolerances and alignment with adjacent work.

B. Maximum Variation From Plumb: 1/16 inch.

C. Maximum Variation From Level: 1/16 inch.

D. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch per 10 ft straight edge.

3.04 ADJUSTING

A. Adjust operating assemblies for smooth and noiseless operation.

3.05 CLEANING

A. Clean installed components.

B. Remove labels and visible markings.

END OF SECTION

SECTION 08 42 29
AUTOMATIC ENTRANCES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Packaged power-operated door assemblies.

B. Operators for doors provided in other sections.

C. Controllers, actuators and safety devices.

1.02 RELATED REQUIREMENTS

A. Section 08 43 13 Aluminum-Framed Storefronts: Storefront frames and doors to receive automatic entrance hardware

B. Section 26 27 17 - Equipment Wiring.

C. Section 28 31 00 - Fire Detection and Alarm: Connection to fire alarm system.

1.03 REFERENCE STANDARDS

A. BHMA A156.10 - American National Standard for Power Operated Pedestrian Doors; Builders Hardware Manufacturers Association; 2011 (ANSI/BHMA A156.10).

B. NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association; 2014.

C. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings:
   1. Indicate layout and dimensions; head, jamb, and sill conditions; elevations; components, anchorage, recesses, materials, and finishes, electrical characteristics and connection requirements.
   2. Identify installation tolerances required, assembly conditions, routing of service lines and conduit, and locations of operating components and boxes.

C. Product Data: Provide data on system components, sizes, features, and finishes.

D. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention, and manufacturer's hardware and component templates.

E. Project Record Documents: Record actual locations of concealed equipment, services, and conduit.

F. Maintenance Data: Include manufacturer's parts list and maintenance instructions for each type of hardware and operating component.

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

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Wrenches and other tools required for maintenance of equipment.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum three years of experience.

1.06 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide two year manufacturer warranty.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Door Operators for Swing Doors Specified in Other Sections:
   1. ASSA ABLOY Entrance Solutions; Besam SW200i - IG: www.besam-usa.com.
   2. Horton Automatics: www.hortondoors.com.
   3. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 POWER OPERATED DOORS

A. Power Operated Doors: Provide products that comply with the requirements of the authorities having jurisdiction; unless otherwise indicated, provide equipment selected for the actual weight of the doors and for light pedestrian traffic.
   1. Swinging Door Operators: Fully adjustable for opening and closing speeds, checking speeds, and hold-open time; in the event of power failure, disengage operator allowing door to function as a door with a spring closer.
   2. Exterior Swinging Doors: Provide equipment capable of operating, closing, and holding closed under positive and negative differential pressure; if necessary, provide power closing.

B. Swinging Doors with Full Power Operators: Comply with BHMA A156.10; safeties required.
   1. Comply with UL 325; acceptable evidence of compliance includes current UL or ULC listing.

2.03 OPERATORS FOR SWINGING DOORS PROVIDED BY OTHERS

A. Door Operator, Type ASSA ABLOY Entrance Solutions; Besam SW200i Surface Mounted: Electric, surface mounted overhead.
   1. Operation: Full-power open, power close operation.
   2. Variable speed control for opening and closing cycles.
   3. "Push" Side Actuator: Push button.
   4. "Pull" Side Actuator: Push button.
   5. "Pull" Side Safety: Door-mounted.
   6. Hold Open: Toggle switch at inside head of doors; deactivate hold-open on activation of fire alarm system.

2.04 CONTROLLERS, ACTUATORS, AND SAFETIES

A. Push Button Actuator: Standard momentary contact type, wall mounted, surface; stainless steel escutcheon plate with ADA symbol

2.05 ELECTRICAL CHARACTERISTICS AND COMPONENTS

A. Electrical Characteristics:
   1. 120/208 volts, single phase, 60 Hz.
   2. 10 amperes maximum fuse size.
   3. Refer to Section 26 27 17: Electrical connections.

B. Motors: NEMA MG 1.

C. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70.

D. Disconnect Switch: Factory mount disconnect switch in control panel.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are ready to receive work and dimensions are as indicated on shop drawings.

B. Verify that electric power is available and is of the correct characteristics.

3.02 INSTALLATION

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

B. Provide for thermal expansion and contraction of door and frame units and live and dead loads that may be transmitted to operating equipment.

C. Provide for dimensional distortion of components during operation.

D. Coordinate installation of components with related and adjacent work; level and plumb.

3.03 ADJUSTING

A. Adjust door equipment for correct function and smooth operation.

3.04 CLEANING

A. Remove temporary protection, clean exposed surfaces.

3.05 CLOSEOUT ACTIVITIES

A. Demonstrate operation, operating components, adjustment features, and lubrication requirements.

END OF SECTION

SECTION 08 43 13

ALUMINUM-FRAMED STOREFRONTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aluminum-framed storefront windows, with vision glass.

B. Infill panels of metal and insulated pre-manufuctered metal panels, custom shop fabricated insulated metal panels and infill panels constructed with insulation only.

C. Aluminum doors and frames.

D. Door hardware.

1.02 RELATED REQUIREMENTS

A. Section 05 50 00 - Metal Fabrications: Steel attachment devices.

B. Section 07 21 00 - Thermal Insulation: Insulation used inside aluminum framed storefronts

C. Section 07 43 13 - Insulated Metal Wall Panels: Storefront windows installed with insulated metal panel siding

D. Section 07 90 05 - Joint Sealers: Sealing joints between frames and adjacent construction

E. Section 08 42 29 - Automatic Entrances. Provide frames and doors to receive automatic door entrance hardware

F. Section 08 44 13 - Glazed Aluminum Curtain Walls.

G. Section 08 71 00 - Door Hardware: Hardware items other than specified in this section.

H. Section 08 80 00 - Glazing: Glass and glazing accessories.

I. Section 12 21 13 - Horizontal Louver Blinds: Attachments to framing members.

1.03 REFERENCE STANDARDS

A. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site; American Architectural Manufacturers Association; 2012.

B. AAMA 501.2 - Field Check of Metal Storefronts, Curtain Walls, and Sloped Glazing Systems for Water Leakage; American Architectural Manufacturers Association; 2009 (part of AAMA 501).

C. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; American Architectural Manufacturers Association; 2012.

D. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections; American Architectural Manufacturers Association; 2009.

E. ASCE 7 - Minimum Design Loads for Buildings and Other Structures; American Society of Civil Engineers; 2011.

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

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

H. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2013.

I. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric]; 2013.

J. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2004 (Reapproved 2012).

K. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014.

L. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2009).

M. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2009).

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with installation of other components that comprise the exterior enclosure.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related Work, expansion and contraction joint location and details, and field welding required. Provide coordination drawings for frames and doors to receive automatic door hardware

C. Design Data: Provide framing member structural and physical characteristics, engineering calculations, and dimensional limitations. Shop drawings and engineering calculations to be sealed by an Oregon licensed Engineer.

D. Hardware Schedule: Complete itemization of each item of hardware to be provided for each door, cross-referenced to door identification numbers in Contract Documents.

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

1.06 QUALITY ASSURANCE

A. Designer Qualifications: Design structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed at the State in which the Project is located.

B. Manufacturer and Installer Qualifications: Company specializing in manufacturing aluminum glazing systems with minimum three years of documented experience.

1.07 MOCK-UP

A. See Section 01 40 00 - Quality Requirements, for general requirements for mock-ups.

B. Provide 10 feet by 13 feet feet mock-up including each component being used on the project. Assemble to illustrate component assembly including glazing materials, weep drainage system, attachments, anchors, and perimeter sealant.

C. Locate on-site where directed by Architect. Mock-up may remain as part of the Work.

D. Locate off-site where directed. Remove when directed.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Handle products of this section in accordance with AAMA CW-10.

B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.09 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F. Maintain this minimum temperature during and 48 hours after installation.

1.10 WARRANTY

A. See Section 01 7000 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.

C. Provide five year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design: Manufacturer: Kawneer System: Trifab VG 451T

B. Other Acceptable Manufacturers:
   1. Kawneer North America: www.kawneer.com.
   2. Tubelite, Inc: www.tubeliteinc.com.
   3. Arcadia:
   4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 STOREFRONT

A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
   1. Glazing Position: Front-set.
   2. Vertical Mullion Dimensions: 2 inches wide by 4-1/2 inches deep.
   3. Thermal Resistance: Comply with the current version of the State of Washington Energy Code
   4. Finish: Superior performing organic coatings.
      a. Factory finish all surfaces that will be exposed in completed assemblies.
      b. Touch-up surfaces cut during fabrication so that no natural aluminum is visible in completed assemblies, including joint edges.
   5. Finish Color: As selected by Architect from manufacturer's standard line.
   6. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.
   7. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
   8. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
   9. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
   10. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
   11. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
   12. Preparation for Window Treatments: Provide reinforced interior horizontal head rail.

B. Performance Requirements:
   1. Wind Loads: Design and size components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330/E330M, using loads 1.5 times the design wind loads and 10 second duration of maximum load.
      a. Design Wind Loads: Comply with requirements of ASCE 7.
      b. Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.
   2. Water Penetration Resistance: No uncontrolled water on interior face, when tested in accordance with ASTM E331 at pressure differential of 8.00 lbf/sq ft.
   3. Air Leakage: Maximum of 0.06 cu ft/min/sq ft of wall area, when tested in accordance with ASTM E283 at 6.27 pounds per square foot pressure differential across assembly.
   4. Condensation Resistance Factor of Framing: 50, minimum, measured in accordance with AAMA 1503.
   5. Air Infiltration: Limit air infiltration through assembly to 0.06 cu ft/min/sq ft of wall area, measured at specified differential pressure across assembly in accordance with ASTM E283.

2.03 COMPONENTS

A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.

B. Infill Panels: Insulated, aluminum sheet face and back, with edges formed to fit glazing channel and sealed.

C. Swing Doors: Glazed aluminum.
   1. Thickness: 1-3/4 inches.
   2. Top Rail: 3 1/2 inches wide.
   3. Vertical Stiles: 3 1/2 inches wide.
   4. Bottom Rail: 10 inches wide.
   5. Glazing Stops: Square.
   6. Finish: Same as storefront.

2.04 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M).

B. Sheet Aluminum: ASTM B209 (ASTM B209M).

C. Fasteners: Stainless steel.

D. Glass: As specified in Section 08 80 00.

E. Aluminum Trim and sill pan flashing:
   1. Material: Aluminum
   2. Thickness: 0.032 inches
   3. Color: Match storefront color
   4. Size: As indicated

F. Shims: Plastic or hard neoprene, size to suit application

G. Pre-fabricated Water Resistant Opaque Glazing Aluminum Infill Panels:
   1. Manufacturer: Citadel Product Industries; www.citadelap.com; Product: GlazeGuard 1000 WR Plus;
   2. Finish: Smooth Skin with clear anodized aluminum finish with minimum 0.7 mil anodic coating
   3. Core: Polyisocyanurate 11/16 inch thick; R -value=5
   4. Nominal Thickness: 1 inch

H. Custom Shop Fabricated Interior Aluminum Faced Infill panels (within finished spaces)
   1. Aluminum materials
      a. Finish: Match storefront color and finish
      b. Thickness: 0.05 inches
   2. Insulation: Extruded Polystyrene: Thickness 2 1/2 inches
   3. Adhesive: Suitable for bonding aluminum to aluminum and for laminating the insulation to aluminum panel face

I. Custom Fabricated Insulation Panels (above the ceiling)
   1. Insulation: One 1 inch panel and one 2 inch thick panel laminated together.

2.05 FINISHES

A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils thick.

2.06 HARDWARE

A. For each door, include weatherstripping, sill sweep strip, and threshold.

B. Weatherstripping: Wool pile, continuous and replaceable; provide on all doors.

C. Sill Sweep Strips: Resilient seal type, retracting, of neoprene; provide on all doors.

D. Threshold: Extruded aluminum, one piece per door opening, ribbed surface; provide on all doors.

E. Pivots: Center type; top and bottom.

F. Exit Devices: Panic type.

G. Door Closers: Concealed overhead.

H. Automatic Door Operators and Actuators: As specified in Section 08 42 29.

2.07 FABRICATION

A. Fabricate components with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.

B. Accurately fit and secure joints and corners. Make joints flush, hairline, and weatherproof.

C. Prepare components to receive anchor devices. Fabricate anchors.

D. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.

E. Arrange fasteners and attachments to conceal from view.

F. Reinforce components internally for door hardware and door operators.

G. Reinforce framing members for imposed loads.

H. Finishing: Apply factory finish to all surfaces that will be exposed in completed assemblies.
   1. Touch-up surfaces cut during fabrication so that no natural aluminum is visible in completed assemblies, including joint edges.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify dimensions, tolerances, and method of attachment with other work.

B. Verify that wall openings and adjoining air and vapor seal materials are ready to receive work of this section.

3.02 INSTALLATION

A. Install door system in accordance with manufacturer's instructions.

B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

C. Provide alignment attachments and shims to permanently fasten system to building structure.

D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.

E. Provide thermal isolation where components penetrate or disrupt building insulation.

F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.

G. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.

H. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

I. Install operating sash.

J. Set thresholds in bed of sealant and secure.

K. Install hardware using templates provided.
   1. See Section 08 71 00 for hardware installation requirements.
   2. See Section 08 42 29 for operator and actuator installation requirements.

L. Install glass and infill panels in accordance with Section 08 80 00, using glazing method required to achieve performance criteria.

M. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

N. Card Key Access: Reinstall existing card key access control with new doors

3.03 TOLERANCES

A. Maximum Variation from Plumb: 0.06 inches every 3 ft non-cumulative or 1/16 inches per 10 ft, whichever is less.

B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

C. Maximum Variation from Plumb: 1/16 inch

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for independent testing and inspection requirements. Inspection will monitor quality of installation and glazing.

3.05 ADJUSTING

A. Adjust operating hardware for smooth operation.

3.06 CLEANING

A. Remove protective material from pre-finished aluminum surfaces.

B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.

3.07 PROTECTION

A. Protect installed products from damage during subsequent construction.

END OF SECTION

SECTION 08 44 13
GLAZED ALUMINUM CURTAIN WALLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aluminum-framed curtain wall, with vision glazing and glass, metal, and stone infill panels.

B. Aluminum-framed sloped curtain wall, self-supporting, with vision glazing.

C. Firestopping between curtain wall and edge of floor slab.

1.02 RELATED REQUIREMENTS

A. Section 05 50 00 - Metal Fabrications: Steel attachment devices.

B. Section 07 84 00 - Firestopping: Firestop at system junction with structure.

C. Section 08 42 29 - Automatic Entrances.

D. Section 08 43 13 - Aluminum-Framed Storefronts: Entrance framing and doors.

E. Section 08 80 00 - Glazing.

1.03 REFERENCE STANDARDS

A. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site; American Architectural Manufacturers Association; 2012.

B. AAMA 501.2 - Field Check of Metal Storefronts, Curtain Walls, and Sloped Glazing Systems for Water Leakage; American Architectural Manufacturers Association; 2009 (part of AAMA 501).

C. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document); American Architectural Manufacturers Association; 2015.

D. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; American Architectural Manufacturers Association; 2012.

E. ASCE 7 - Minimum Design Loads for Buildings and Other Structures; American Society of Civil Engineers; 2011.

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

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

H. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.

I. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric]; 2013.

J. ASTM C794 - Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants; 2015.

K. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2004 (Reapproved 2012).

L. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014.

M. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2009).

1.04 ADMINISTRATIVE REQUIREMENTS

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, internal drainage details, glazing, _____, and infill.

C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related Work, expansion and contraction joint location and details, and field welding required. Shop drawings to be sealed by an Oregon licensed engineer.

D. Design Data: Provide framing member structural and physical characteristics and engineering calculations, and identify dimensional limitations; include load calculations at points of attachment to building structure. Calculations to be sealed by and Oregon licensed Engineer.

E. Test Reports: Submit results of full-size mock-up testing. Reports of tests previously performed on the same design are acceptable.

F. Field Quality Control Submittals: Report of field testing for water leakage.

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

1.06 QUALITY ASSURANCE

1.07 DELIVERY, STORAGE, AND HANDLING

A. Handle products of this section in accordance with AAMA CW-10.

B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.08 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

C. Provide five year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Glazed Aluminum Curtain Wall:
   1. Kawneer North America; Basis of Design: Kawneer 1600 Wall System with 2 1/2 inch sightline and 6 inch depth: www.kawneer.com.
   2. Tubelite, Inc: www.tubeliteinc.com.
   3. Arcadia.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 CURTAIN WALL

A. Aluminum-Framed Curtain Wall: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
   1. Outside glazed, with pressure plate and mullion cover.
   2. Fabrication Method: Either shop/factory or field fabricated system.
   3. Glazing Method: Either shop/factory or field glazed system.
   4. Vertical Mullion Face Width: 2-1/2 inches.
   5. Vertical Mullion Depth From Face of Glazing to Back of Frame: 6-1/4 inches.
   6. Finish: Class I natural anodized.
      a. Factory finish surfaces that will be exposed in completed assemblies.
      b. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.
   7. Provide flush joints and corners, weathersealed, accurately fitted and secured; prepared to receive anchors; fasteners and attachments concealed from view; reinforced as required for imposed loads.
   8. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
   9. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.

B. Structural Performance Requirements: Design and size components to withstand the following load requirements without damage or permanent set.
   1. Design Wind Loads: Comply with with the Technical Memorandum appended to these specfications
      a. Measure performance by testing in accordance with ASTM E330/E330M, using test loads equal to 1.5 times the design wind loads and 10 second duration of maximum pressure.
      b. Member Deflection: For spans less than 13 feet 6 inches, limit member deflection to flexure limit of glass in any direction, and maximum of 1/175 of span or 3/4 inch, whichever is less and with full recovery of glazing materials.
      c. Member Deflection: For spans over 13 feet 6 inches and less than 40 feet, limit member deflection to flexure limit of glass in any direction, and maximum of 1/240 of span plus 1/4 inch, with full recovery of glazing materials.
   2. Seismic Loads: Design and size components to withstand seismic loads and sway displacement in accordance with the requirements of ASCE 7.
   3. Movement: Accommodate the following movement without damage to components or deterioration of seals:
      a. Expansion and contraction caused by 180 degrees F surface temperature.
      b. Expansion and contraction caused by cycling temperature range of 170 degrees F over a 12 hour period.
      c. Movement of curtain wall relative to perimeter framing.
      d. Deflection of structural support framing, under permanent and dynamic loads.

C. Water Penetration Resistance: No uncontrolled water on indoor face when tested as follows:
   1. Test Pressure Differential: 10 lbf/sq ft.
   2. Test Method: ASTM E331.

D. Air Leakage: Maximum of 0.06 cu ft/min/sq ft of wall area, when tested in accordance with ASTM E283 at 6.27 pounds per square foot pressure differential across assembly.

E. Thermal Performance Requirements:
   1. Overall U-value Including Glazing:.45 Btu/(hr sq ft deg F), maximum.

2.03 COMPONENTS

A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.

B. Glazing: As specified in Section 08 80 00.

C. Infill Panels: Provide both pre-fabricated (exterior) and shop fabricated (interior) insulated, aluminum panels, with edges formed to fit glazing channel and sealed as defined in section 08 43 13

2.04 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M).

B. Sheet Aluminum: ASTM B209 (ASTM B209M).

C. Structural Supporting Anchors: See Section 05 12 00.

D. Structural Supporting Anchors Attached to Structural Steel: Design for bolted attachment.

E. Structural Supporting Anchors Attached to Reinforced Concrete Members: Design for welded attachment to weld plates embedded in concrete.

F. Fasteners: Stainless steel; type as required or recommended by curtain wall manufacturer.

G. Flashings: Aluminum sheet, 20 gage, 0.032 inch minimum thickness; finish to match framing members.

H. Weatherseal Sealant: Silicone, with adhesion in compliance with ASTM C794; compatible with glazing accessories.

I. Sill Flashing Sealant: Elastomeric, silicone or polyurethane, and compatible with flashing material.

J. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.

K. Glazing Accessories: As specified in Section 08 80 00.

L. Shop and Touch-Up Primer for Steel Components: Zinc oxide, alkyd, linseed oil primer appropriate for use over hand cleaned steel.

2.05 FINISHES

A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils thick.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify dimensions, tolerances, and method of attachment with other related work.

B. Verify that curtain wall openings and adjoining air and vapor seal materials are ready to receive work of this section.

C. Verify that anchorage devices have been properly installed and located.

3.02 INSTALLATION

A. Install curtain wall system in accordance with manufacturer's instructions.

B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

C. Provide alignment attachments and shims to permanently fasten system to building structure.

D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.

E. Provide thermal isolation where components penetrate or disrupt building insulation.

F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.

G. Sloped Glazing with External Horizontal Mullions: Place sealant on the upslope side of the pressure plate cover caps; finish the surface with a slope for drainage over the cap.

H. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 TOLERANCES

A. Maximum Variation from Plumb: 0.06 inches every 3 ft non-cumulative or 0.5 inches per 100 ft, whichever is less.

B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

C. Sealant Space Between Curtain Wall Mullions and Adjacent Construction: Maximum of 3/4 inch and minimum of 1/4 inch.

3.04 FIELD QUALITY CONTROL

A. Provide the services of the manufacturer's field representative to observe installation and make report.

B. See Section 01 40 00 - Quality Requirements, for independent testing and inspection requirements. Inspection will monitor quality of installation and glazing.

C. Test installed curtain wall for water leakage in accordance with AAMA 501.2.

D. Replace curtain wall components that have failed field testing and retest until performance is satisfactory.

3.05 ADJUSTING

A. Adjust operating sash for smooth operation.

3.06 CLEANING

A. Remove protective material from pre-finished aluminum surfaces.

B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.

C. Upon completion of installation, thoroughly clean aluminum surfaces in accordance with AAMA 609 & 610.

3.07 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION

SECTION 08 71 00

DOOR HARDWARE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Hardware for wood and aluminum doors.

B. Hardware for fire-rated doors.

C. Electrically operated and controlled hardware.

D. Lock cylinders for doors that hardware is specified in other sections.

E. Thresholds.

F. Weatherstripping, seals and door gaskets.

1.02 RELATED REQUIREMENTS

A. Section 08 12 13 - Hollow Metal Frames.

B. Section 08 14 16 - Flush Wood Doors.

C. Section 08 33 13 - Coiling Counter Doors: Lockable coiling doors.

D. Section 08 42 29 - Automatic Entrances: Power operators.

E. Section 08 43 13 - Aluminum-Framed Storefronts: Hardware for same except cylinders; installation of cylinders.

1.03 REFERENCE STANDARDS

A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.

B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

C. BHMA A156.1 - American National Standard for Butts and Hinges; Builders Hardware Manufacturers Association, Inc.; 2013 (ANSI/BHMA A156.1).

D. BHMA A156.2 - American National Standard for Bored and Preassembled Locks & Latches; Builders Hardware Manufacturers Association; 2011 (ANSI/BHMA A156.2).

E. BHMA A156.3 - American National Standard for Exit Devices; Builders Hardware Manufacturers Association; 2014 (ANSI/BHMA A156.3).

F. BHMA A156.4 - American National Standard for Door Controls - Closers; Builders Hardware Manufacturers Association, Inc.; 2013 (ANSI/BHMA A156.4).

G. BHMA A156.5 - American National Standard for Cylinders and Input Devices for Locks; Builders Hardware Manufacturers Association; 2014 (ANSI/BHMA A156.5).

H. BHMA A156.6 - American National Standard for Architectural Door Trim; Builders Hardware Manufacturers Association; 2010 (ANSI/BHMA A156.6).

I. BHMA A156.7 - American National Standard for Template Hinge Dimensions; Builders Hardware Manufacturers Association; 2014 (ANSI/BHMA A156.7).

J. BHMA A156.8 - American National Standard for Door Controls - Overhead Stops and Holders; Builders Hardware Manufacturers Association, Inc.; 2010 (ANSI/BHMA A156.8).

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

L. BHMA A156.12 - American National Standard for Interconnected Locks; Builders Hardware Manufacturers Association; 2013 (ANSI/BHMA A156.12).

M. BHMA A156.13 - American National Standard for Mortise Locks & Latches Series 1000; Builders Hardware Manufacturers Association; 2012 (ANSI/BHMA A156.13).

N. BHMA A156.14 - American National Standard for Sliding & Folding Door Hardware; Builders Hardware Manufacturers Association; 2013 (ANSI/BHMA A156.14).

O. BHMA A156.17 - American National Standard for Self Closing Hinges & Pivots; Builders Hardware Manufacturers Association, Inc.; 2014 (ANSI/BHMA A156.17).

P. BHMA A156.18 - American National Standard for Materials and Finishes; Builders Hardware Manufacturers Association, Inc.; 2012 (ANSI/BHMA A156.18).

Q. BHMA A156.21 - American National Standard for Thresholds; Builders Hardware Manufacturers Association; 2014 (ANSI/BHMA A156.21).

R. BHMA A156.22 - American National Standard for Door Gasketing and Edge Seal Systems, Builders Hardware Manufacturers Association; 2012 (ANSI/BHMA A156.22).

S. BHMA A156.115 - American National Standard for Hardware Preparation in Steel Doors and Steel Frames; 2014 (ANSI/BHMA A156.115).

T. BHMA A156.115W - American National Standard for Hardware Preparation in Wood Doors with Wood or Steel Frames; 2006 (ANSI/BHMA A156.115W).

U. DHI (LOCS) - Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames; Door and Hardware Institute; 2004.

V. DHI WDHS.3 - Recommended Locations for Architectural Hardware for Flush Wood Doors; Door and Hardware Institute; 1993; also in WDHS-1/WDHS-5 Series, 1996.

W. ICC A117.1 - Accessible and Usable Buildings and Facilities; International Code Council; 2009 (ANSI).

X. UL (BMD) - Building Materials Directory; Underwriters Laboratories Inc.; current edition.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the manufacture, fabrication, and installation of products that door hardware will be installed upon.

B. Furnish templates for door and frame preparation to manufacturers and fabricators of products requiring internal reinforcement for door hardware.

C. Convey Owner's keying requirements to manufacturers.

D. Preinstallation Meeting: Convene a preinstallation meeting one week prior to commencing work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's catalog literature for each type of hardware, marked to clearly show products to be furnished for this project.

C. 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.

D. Keying Schedule: Submit for approval of Owner.

E. Samples: Prior to preparation of hardware schedule:
   1. Submit one (1) sample of hinge, latchset, lockset, and closer illustrating style, color, and finish.
   2. Samples will be returned to supplier.

F. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention.

G. Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.

H. Keys: Deliver with identifying tags to Owner by security shipment direct from hardware supplier.

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

J. Project Record Documents: Record actual locations of concealed equipment, services, and conduit.

K. Maintenance Materials and Tools: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Lock Cylinders: Ten for each master keyed group.
   3. Tools: One set of all special wrenches or tools applicable to each different or special hardware component, whether supplied by the hardware component manufacturer or not.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years of documented experience.

B. Hardware Supplier Qualifications: Company specializing in supplying commercial door hardware with five years of experience.

C. Hardware Supplier Personnel: Employ an Architectural Hardware Consultant (AHC) to assist in the work of this section.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Package hardware items individually; label and identify each package with door opening code to match hardware schedule.

1.08 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide five year warranty for door closers.

PART 2 PRODUCTS

2.01 DOOR HARDWARE SUPPLIERS

A. Builder's Hardware & Supply; 509 586 8110; www.builders-hardware.com.

B. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 MANUFACTURERS

A. Allegion Brands; Ives, LCN, Schlage, Steelcraft, or Von Duprin: www.allegion.com/us.

B. Assa Abloy Brands; Corbin Russwin, Curries, McKinney, Norton, Sargent, Yale, or Pemko: www.assaabloydss.com.

C. Trimco, originally called Triangle Brass Manufacturing Co., Inc: www.trimcohardware.com.

D. Medeco.

E. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 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. Accessibility: ADA Standards and ICC A117.1.
   3. Fire-Rated Doors: NFPA 80.
   4. Hardware Preparation for Steel Doors and Steel Frames: BHMA A156.115.
   5. Hardware for Smoke and Draft Control Doors (Indicated as "S" on Drawings): Provide hardware that enables door assembly to comply with air leakage requirements of the applicable code.
   6. Hardware for Sound rated doors: Provide hardware that maximizes the STC rating of the door including:
      a. Automatic Door Bottom

b. Silicone gasket
c. Threshold

7. Products Requiring Electrical Connection: Listed and classified by UL as suitable for the purpose specified and indicated.

D. Function: Lock and latch function numbers and descriptions of manufactures series as listed in hardware schedule.

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: Identified in schedule.

2.04 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: Grand master keyed.
1. Include construction keying.
2. Supply keys in the following quantities:
a. ____ master keys.
b. ____ grand master keys.
c. ____ construction keys.
d. ____ change keys for each lock.

D. Latches: Provide a latch for every door that is not required to lock, unless specifically indicated "push/pull" or "not required to latch".

2.05 HINGES

A. 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.

B. Butt Hinges: Comply with BHMA A156.1 and A156.7; heavy weight, unless otherwise indicated.

C. Quantity of Hinges Per Door:
1. Doors From 60 inches High up to 90 inches High: Three hinges.

D. Manufacturers - Hinges:
1. Assa Abloy Brands; McKinney: www.assaabloydss.com.
2. Substitutions: See Section 01 60 00 - Product Requirements.

2.06 PIVOTS

A. Pivots: Comply with BHMA A156.17.

B. Manufacturers - Pivots:
1. Assa Abloy Brands; McKinney or Rixson: www.assaabloydss.com.
2. Substitutions: See Section 01 60 00 - Product Requirements.

2.07 CYLINDRICAL LOCKSETS

A. Cylindrical Locksets - Basis of Design: Medeco.

2.08 MORTISE LOCKSETS

A. Mortise Locksets - Basis of Design: Medeco.

B. Locking Functions: As defined in BHMA A156.13, and as follows:
   1. Office: F04, key not required to lock, remains locked upon exit.
   2. Always-Locked: F07, may not be left unlocked.

2.09 AUXILIARY LOCKS (DEADBOLTS)

A. Auxiliary Locks (Deadbolts) - Basis of Design: Medeco.

2.10 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. Manual Flushbolts: Provide lever extensions for top bolt at over-size doors.

C. Self-Latching Flushbolts: Automatically latch upon closing of door; manually retracted.

D. Automatic Flushbolts: Automatically latch upon closing of door; automatic retraction of bolts when active leaf is opened.

E. Coordinators: Provide on doors having closers and self-latching or automatic flushbolts to ensure that leaves close in proper order.

F. Manufacturers - Flushbolts:
   1. Assa Abloy Brands; McKinney: www.assaabloydss.com.
   2. Ives, an Allegion brand: www.allegion.com/us.
   3. Trimco, originally called Triangle Brass Manufacturing Co., Inc: www.trimcohardware.com.

G. Manufacturers - Coordinators:
   1. Any manufacturer listed in this section.
   2. Substitutions: See Section 01 60 00 - Product Requirements.

2.11 ELECTRIC STRIKES

2.12 EXIT DEVICES

A. Exit Devices - Basis of Design: Sargent 8504/8804.

2.13 CLOSERS

A. 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.
   5. At corridors, locate door-mounted closer on room side of door.
   6. At outswinging exterior doors, mount closer in inside of door.

B. Manufacturers - Surface Mounted Closers:
   1. Assa Abloy Brands; Corbin Russwin, Norton, Rixson, Sargent, or Yale: www.assaabloydss.com.

2.14 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. Manufacturers - Overhead Holders/Stops:
   1. Substitutions: See Section 01 60 00 - Product Requirements.

2.15 GASKETING AND THRESHOLDS

A. Gaskets: Complying with BHMA A156.22.
   1. 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.
   2. On each exterior door, provide door bottom sweep, unless otherwise indicated.
   3. 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.

B. Thresholds: Complying with BHMA A156.21.
   1. At each exterior door, provide a threshold unless otherwise indicated.

C. Manufacturers - Gasketing and Thresholds:
   1. Pemko Manufacturing Co: www.pemko.com.
   2. Substitutions: See Section 01 60 00 - Product Requirements.

2.16 PROTECTION PLATES AND ARCHITECTURAL TRIM

A. Protection Plates and Architectural Trim - Basis of Design: Trimco.

B. Protection Plates:
   1. Kickplate: Provide on push side of every door with closer, except aluminum storefront and glass entry doors.

2.17 FIRE DEPARTMENT LOCK BOX

A. Manufacturers - Fire Department Lock Box:
   1. Knox Company; Knox-Box Rapid Entry System: www.knoxbox.com.

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. Comply with the ADA for mounting heights

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 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Section 01 40 00.

B. Provide an Architectural Hardware Consultant to inspect installation and certify that hardware and installation has been furnished and installed in accordance with manufacturer's instructions and as specified.

3.04 ADJUSTING

A. Adjust work under provisions of Section 01 70 00.

B. Adjust hardware for smooth operation.

C. Adjust gasketing for complete, continuous seal; replace if unable to make complete seal.

3.05 CLEANING

A. Clean 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.

3.06 PROTECTION

A. Protect finished Work under provisions of Section 01 70 00.

B. Do not permit adjacent work to damage hardware or finish.

3.07 SCHEDULE - ATTACHED

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.

4.02 SWING DOORS -- LOCKABLE, MAY BE LEFT UNLOCKED, KEY NOT REQUIRED TO LOCK

A. HW-10: Office, Non-Fire-Rated:
   1. Lockset, Office.
   2. Pair: One leaf inactive, with manual flush bolts.

B. HW-10F: Office, Fire-Rated or Exterior:
   1. Closer.
   2. Lockset, Office.
   3. Pair: One leaf inactive; automatic or self-closing flush bolts as required to comply with code. If door fire rating requires astragal, provide coordinator.

4.03 SWING DOORS -- MAY NOT BE LEFT UNLOCKED

A. HW-31: Exit Device, Always-Locked:
   1. Closer.
   2. Exit Device, Rim, Always-Locked.
   3. Pair: Both leaves active; Removable Mullion, removal by key only.

4.04 SWING DOORS -- ELECTRICAL ACCESS CONTROL

A. HW-50: Entry Control, Electric Strike, Fail-Secure, Outswing, Fire-Rated and non-Fire-Rated:
   1. Card Reader, located where indicated.
   2. Closer.
   3. Lockset, Always-Locked.
   4. Electric Strike, Fail-Secure.
   5. Lock Guard.

B. HW-55: After Hours Access Control, Power Assist, Fire-Rated and Non-Fire-Rated:
   1. Card Reader, outside, located where indicated.
   2. Push Actuators, Wall-Mounted, Inside and Outside, located where indicated.
   3. Closer.
   4. Exit Device, Rim, Always-Locked, Electric Latch Retraction.
      a. Fail-secure, remaining locked in event of fire alarm activation or power failure.
      b. Key entry at all times; free egress by pressing push pad at all times.

c. After Hours Entry Control: Upon signal from access control device, bolts are retracted allowing entry.
d. Remote Locking: Switch between locked and dogged open activated from remote location as indicated.

5. Power Operator:
   a. Entry Assist: When exit device is dogged open, outside actuator actuates operator normally. When exit device is locked, interlock between operator, access control device, and exit device allows operator function after exit device bolts are retracted.
   b. Exit Assist: Pressing actuator releases exit device and activates operator.
6. Pair: Both leaves active; vertical rod exit devices.

END OF SECTION

SECTION 08 80 00

GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Glass.

B. Glazing compounds and accessories.

1.02 RELATED REQUIREMENTS

A. Section 08 14 16 - Flush Wood Doors: Glazed lites in doors.

B. Section 08 43 13 - Aluminum-Framed Storefronts: Glazing in storefront system.

C. Section 08 44 13 - Glazed Aluminum Curtain Walls: Glazing furnished by wall manufacturer.

1.03 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; current edition.

B. ASCE 7 - Minimum Design Loads for Buildings and Other Structures; 2011.

C. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2011).

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

E. ASTM C1036 - Standard Specification for Flat Glass; 2011e1.

F. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2012.

G. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass; 2014.

H. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2013.

I. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings; 2012a.

J. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation; 2010.

K. GANA (GM) - GANA Glazing Manual; Glass Association of North America; 2009.

L. GANA (SM) - GANA Sealant Manual; Glass Association of North America; 2008.

M. GANA (LGRM) - Laminated Glazing Reference Manual; Glass Association of North America; 2009.

N. ICC (IBC) - International Building Code; 2012.

O. IGMA TM-3000 - North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use; Insulating Glass Manufacturers Alliance; 1990 (2004).

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data on Glass Types: Provide structural, physical and environmental characteristics, size limitations, special handling or installation requirements.

C. Product Data on Glazing Compounds: Provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colors.

D. Samples: Submit two samples 12 by 12 inch in size of glass and plastic units, showing coloration and design.

E. Samples: Submit 12 inch long bead of glazing sealant, _____ color.

F. Certificates: Certify that products meet or exceed specified requirements.

G. Manufacturer's Certificate: Certify that insulated glass meets or exceeds specified requirements.

1.06 QUALITY ASSURANCE

A. Perform Work in accordance with GANA Glazing Manual and GANA Sealant Manual for glazing installation methods.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience.

1.07 MOCK-UP

A. See Section 01 40 00 - Quality Requirements, for additional mock-up requirements.

B. Provide mock-up of storefront window system including glass , frame, siding, flashing, sealant and perimeter foamed in place insulation.

C. Locate where directed by Architect.

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

1.08 FIELD CONDITIONS

A. Do not install glazing when ambient temperature is less than 50 degrees F.

B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.09 WARRANTY

A. See Section 01 78 00 - 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.

C. Laminated Glass: Provide a five (5) year warranty to include coverage for delamination, including replacement of failed units.

PART 2 PRODUCTS

2.01 INSULATING GLASS UNITS

2.02 BASIS OF DESIGN - INSULATING GLASS UNITS

A. Type IG-1 - Sealed Insulating Glass Units: Vision glazing, with Low-E coating.
   1. Application: All exterior glazing unless otherwise indicated.
   2. Between-lite space filled with argon.
   3. Thermal Resistance (U-Value):.28, nominal.
   4. Total Solar Heat Gain Coefficient:.3, nominal.
   5. Total Visible Light Transmittance: 46 percentto 50 percent.
   6. Basis of Design: PGE
   7. Outboard Lite: Fully tempered float glass, 1/4 inch thick, minimum.
      a. 6mmm Solarban z50 (2) on Optiblue
         1) Tint: Blue.
   8. Inboard Lite: Heat-strengthened float glass, 1/4 inch thick.
      a. 6mm Sungate 600 (4) on clear
      b. Tint: Clear.
   9. Total Thickness: 1 inch.
   10. Other Manufacturers: Provide either the product identified as "Basis of Design" or an equivalent product of another acceptable manufacturer.
   11. Substitution Procedures: See Section 01 60 00 - Product Requirements.

2.03 EXTERIOR GLAZING ASSEMBLIES

A. Performance Criteria: Select type and thickness of glass to withstand dead and live loads caused by positive and negative wind pressure acting normal to plane of glass.

1. Glass thicknesses listed are minimum.

2.04 GLASS MATERIALS

A. Float Glass Manufacturers:
   1. AGC Glass Company North America, Inc: www.us.agc.com.
   2. Cardinal Glass Industries: www.cardinalcorp.com.
   3. Guardian Industries Corp: www.sunguardglass.com.
   4. Pilkington North America Inc: www.pilkington.com/na.
   5. PPG Industries, Inc: www.ppgideascapes.com.
   6. Substitutions: Refer to Section 01 60 00 - Product Requirements.

B. Float Glass: Provide float glass based glazing unless noted otherwise.
   1. Heat-Strengthened and Fully Tempered Types: ASTM C1048, Kind HS and Kind FT.
   2. Tinted Types: ASTM C1036, Class 2 - Tinted, color and performance characteristics as indicated.
   3. Thicknesses: As indicated; for exterior glazing comply with requirements indicated for wind load design regardless of thickness indicated.

2.05 SEALED INSULATING GLASS UNITS

A. Manufacturers:
   1. Any of the manufacturers specified for float glass.
   2. Fabricator certified by glass manufacturer for type of glass, coating, and treatment involved and capable of providing specified warranty.
   3. Substitutions: Refer to Section 01 60 00 - Product Requirements.

B. Sealed Insulating Glass Units: Types as indicated.
   1. Durability: Certified by an independent testing agency to comply with ASTM E2190.
   2. Edge Spacers: Aluminum, bent and soldered corners.
   3. Edge Seal: Glass to elastomer with supplementary silicone sealant.
   4. Purge interpane space with dry hermetic air.

2.06 GLAZING COMPOUNDS

A. Manufacturers:
   1. Dow Corning: Product 995 Structural Glazing Sealant
   2. Substitutions: Refer to Section 01 60 00 - Product Requirements.

B. Butyl Sealant, Type A: Single component; ASTM C920, Grade NS, Class 12-1/2, Uses M and A, Shore A hardness of 10 to 20; black color.

C. Silicone Sealant, Type B: Single component; neutral curing; capable of water immersion without loss of properties; non-bleeding, non-staining; ASTM C920, Type S, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 15 to 25; Custom color.

2.07 GLAZING ACCESSORIES

A. Setting Blocks: Neoprene, 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot 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.

B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness; ASTM C864 Option II. Minimum 3 inch long x one half the height of the glazing stop x thickness to suit application, self adhesive on one face.

C. Glazing Tape, Back Bedding Mastic Type: Preformed, butyl-based, 100 percent solids compound with integral resilient spacer rod applicable to application indicated; hardness range of 5 to 30 cured Shore A durometer; coiled on release paper; black color.

D. Glazing Gaskets: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; black color.

E. Glazing Clips: Manufacturer's standard type.

2.08 SOURCE QUALITY CONTROL

A. Provide shop inspection and testing for _____ glass.

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/INTERIOR DRY METHOD (GASKET GLAZING)

A. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.

B. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.

C. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

3.04 INSTALLATION - INTERIOR DRY METHOD (TAPE AND TAPE)

A. Cut glazing tape to length and set against permanent stops, projecting 1/16 inch above sight line.

B. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.

C. Rest glazing on setting blocks and push against tape for full contact at perimeter of pane or unit.

D. Place glazing tape on free perimeter of glazing in same manner described above.

E. Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.

F. Knife trim protruding tape.

3.05 CLEANING

A. Remove glazing materials from finish surfaces.

B. Remove labels after Work is complete.

C. Clean glass and adjacent surfaces.

3.06 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.

3.07 SCHEDULE

A. Aluminum-Framed Storefront Glazing: Type IG-1, exterior dry method, and glass thickness as required to comply with performance requirements indicated in Section 08 43 13.

B. Interior Door and Hollow Metal Frame Glazing: 1/4 inch Float Glass. Dry method

END OF SECTION

SECTION 09 21 16
GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal stud wall framing.

B. Acoustic insulation.

C. Gypsum wallboard.

D. Joint treatment and accessories.

E. Textured finish system.

F. Acoustic (sound-dampening) wall and ceiling board.

G. Specialized gypsum wall board products used for shearwalls

1.02 RELATED REQUIREMENTS

A. Section 05 40 00 - Cold-Formed Metal Framing: Exterior wind-load-bearing metal stud framing.

B. Section 06 10 00 - Rough Carpentry: Wood blocking product and execution requirements.

C. Section 09 30 00 - Tiling: Tile backing board.

1.03 REFERENCE STANDARDS

A. AISI S100-12 - North American Specification for the Design of Cold-Formed Steel Structural Members; American Iron and Steel Institute; 2012.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2013.

C. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2012.

D. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members; 2014.

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

F. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2011.

G. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2013.

H. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2011.

I. 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.

J. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base; 2014a.

K. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2014.

L. GA-216 - Application and Finishing of Gypsum Board; Gypsum Association; 2013.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate special details associated with fireproofing and acoustic seals.

C. Product Data: Provide data on metal framing, gypsum board, accessories, and joint finishing system.

D. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing gypsum board application and finishing, with minimum 3 years of documented experience.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C840 and GA-216.

2.02 METAL FRAMING MATERIALS

A. Non-Loadbearing Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/360 at 5 psf.
   1. Studs: "C" shaped with flat or formed webs .
   2. Runners: U shaped, sized to match studs.

B. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection using slotted holes, screws and anti-friction bushings, preventing rotation of studs while maintaining structural performance of partition.
   1. Structural Performance: Maintain lateral load resistance and vertical movement capacity required by applicable code, when evaluated in accordance with AISI SG02-1.
   2. Material: ASTM A653/A653M steel sheet, SS Grade 50/340, with G60/Z180 hot dipped galvanized coating.

2.03 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board:
   1. American Gypsum Company: www.americangypsum.com.
   2. CertainTeed Corporation: www.certainteed.com.
   3. Georgia-Pacific Gypsum: www.gpgypsum.com.
   4. National Gypsum Company: www.nationalgypsum.com.
   5. USG Corporation: www.usg.com.
   6. Substitutions: See Section 01 60 00 - Product Requirements.

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. Type: Use type Type X board, UL or WH listed at all locations
   3. Thickness: 5/8" inch
   4. Ceilings: 5/8 inch.

C. Backing Board For Wet Areas:
   1. Application: Surfaces behind tile in wet areas including restrooms .
   2. Manufacturer: Georgia Pacific; Product Denshield Tile Backer - Type X
   3. Thickness: 5/8 inch thick

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 inch.
   3. Edges: Tapered.
   4. Type: Type X

2.04 ACCESSORIES

A. Acoustic Insulation: ASTM C665; preformed glass fiber, friction fit type, unfaced. Thickness: 3 inch.

B. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.

C. Sound Board: Manufacturer: Homasote; Product 440 Soundbarrier

1. Thickness: 1/2 inch

D. Finishing Accessories: ASTM C1047, galvanized steel or rigid plastic, unless noted otherwise.
   1. Types: As detailed or required for finished appearance.
   2. Special Shapes: In addition to conventional corner bead and control joints, provide U-bead at exposed panel edges.

E. Joint Materials: ASTM C475 and as recommended by gypsum board manufacturer for project conditions.
   1. Tape: 2 inch wide, creased paper tape for joints and corners, except as otherwise indicated.
   2. Ready-mixed vinyl-based joint compound.

F. High Build Drywall Surfacer: Vinyl acrylic latex-based coating for spray application, designed to take the place of skim coating and separate paint primer in achieving Level 5 finish.

G. Textured Finish Materials: Latex-based compound; plain.

H. Screws for Attachment to Steel Members Less Than 0.033 inch In Thickness, to Wood Members, and to Gypsum Board: ASTM C1002; self-piercing tapping type; cadmium plated for exterior locations.

I. Screws for Attachment to Steel Members From 0.033 to 0.112 inch in Thickness: ASTM C954; steel drill screws for application of gypsum board to loadbearing steel studs.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

3.02 FRAMING INSTALLATION

A. Metal Framing: Install in accordance with ASTM C754 and manufacturer's instructions.

B. Studs: Space studs at 16 inches on center.
   1. Extend partition framing to structure where indicated and to ceiling in other locations.
   2. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.
   3. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical devices in accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track.

C. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.

D. Blocking: Install wood blocking for support of:
   1. Wall mounted cabinets.
   2. Plumbing fixtures.
   3. Toilet partitions.
   4. Toilet accessories.
   5. Wall mounted door hardware.

3.03 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 two beads 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.

3.04 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.

C. Fire-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.

D. Exposed Gypsum Board in Interior Wet Areas: Seal joints, cut edges, and holes with water-resistant sealant.

E. Installation on Metal Framing: Use screws for attachment of gypsum board.

3.05 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.
   2. At exterior soffits, not more than 30 feet apart in both directions.

B. Corner Beads: Install at external corners, using longest practical lengths.

C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials and as indicated.

3.06 JOINT TREATMENT

A. Paper Faced Gypsum Board: Use paper joint tape, bedded with ready-mixed vinyl-based joint compound and finished with ready-mixed vinyl-based joint compound.

B. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
   1. Level 5: Walls and ceilings to receive semi-gloss or gloss paint finish and other areas specifically indicated.
   2. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
   3. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.
   4. Level 1: Wall areas above finished ceilings, whether or not accessible in the completed construction.

C. 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.

D. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.

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 22 36.23

METAL LATH

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal lath for Portland cement and gypsum plaster.

B. Furring for metal lath.

C. Metal ceiling framing.

1.02 RELATED REQUIREMENTS

A. Section 02 4100: Partial demolition of exterior plaster soffits that will be replaced with new plaster soffits

1.03 REFERENCE STANDARDS

A. ASTM C841 - Standard Specification for Installation of Interior Lathing and Furring; 2003 (Reapproved 2013).

B. ASTM C847 - Standard Specification for Metal Lath; 2014a.

C. 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.

D. ASTM C1063 - Standard Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster; 2014b.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on furring and lathing components, structural characteristics, material limitations, and finish.

C. Samples:
   1. Submit two samples, 12 inch by 12 inch inch in size illustrating lath material and finish.

PART 2 PRODUCTS

2.01 FRAMING AND LATH ASSEMBLIES

A. Provide completed assemblies with the following characteristics:
   1. Maximum Deflection of Vertical Assemblies: 1:360 under lateral point load of 100 lbs.
   2. Maximum Deflection of Horizontal Assemblies: 1:240 deflection under dead loads and wind uplift.

2.02 FRAMING MATERIALS

A. Furring Channels: Formed steel, minimum 0.020 inch thick, 3/8 inch deep by 7/8 inch high, splicing permitted; galvanized.

B. Main Ceiling Channels: Formed steel, asphalt coated, minimum 0.05 inch thick, 3/4 inch deep by 1-1/2 inch high, single piece, no splicing; galvanized.

C. Hangers: Steel wire, of size and type to suit application, to support ceiling components in place to deflection limits as indicated.

D. Lateral Bracing: Formed steel, minimum 0.060 inch thick, size and length as required; galvanized.

2.03 LATH

A. Diamond Mesh Metal Lath: ASTM C847, galvanized; self-furring.
   1. Weight: To suit application, comply with deflection criteria, and as specified in ASTM C841 for framing spacing.
   2. Weight: 2.5 lb/sq yd.
   3. Backed with treated paper.

B. Beads, Screeds, Joint Accessories, and Other Trim: Depth governed by plaster thickness, maximum possible lengths.
   1. Material: Formed galvanized sheet steel, expanded metal flanges.
   2. Casing Beads: Square edges.
   3. Vent Screen: Replace at new plaster locations. Match existing vent screen

2.04 ACCESSORIES

A. Fasteners: Self-piercing tapping screws; ASTM C1002.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that substrates are ready to receive work and conditions are suitable for application.

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

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

3.02 INSTALLATION - GENERAL

A. Install interior lath and furring in accordance with ASTM C841.

B. Install lath and furring for Portland cement plaster in accordance with ASTM C1063.

3.03 CEILING AND SOFFIT FRAMING

A. Install furring after work above ceiling or soffit is complete. Coordinate the location of hangers with other work.

B. Install furring independent of walls, columns, and above-ceiling work.

C. Securely anchor hangers to structural members or embed in structural slab. Space hangers as required to limit deflection to criteria indicated. Use rigid hangers at exterior soffits.

D. Space main carrying channels at maximum 72 inch on center, and not more than 6 inches from wall surfaces. Lap splice securely.

E. Securely fix carrying channels to hangers to prevent turning or twisting and to transmit full load to hangers.

F. Place furring channels perpendicular to carrying channels, not more than 2 inches from perimeter walls, and rigidly secure. Lap splices securely.

G. Reinforce openings in suspension system that interrupt main carrying channels or furring channels with lateral channel bracing. Extend bracing minimum 24 inches past each opening.

H. Laterally brace suspension system.

3.04 CONTROL AND EXPANSION JOINTS

A. Expansion Joint Spacing: 10 feet on center and as indicated on drawings.

3.05 LATH INSTALLATION

A. Apply metal lath taut, with long dimension perpendicular to supports.

B. Lap ends minimum 1 inch. Secure end laps with tie wire where they occur between supports.

C. Lap sides of diamond mesh lath minimum 1-1/2 inches.

D. Attach metal lath to metal supports using tie wire at maximum 6 inches on center.

E. Continuously reinforce internal angles with corner mesh, except where the metal lath returns 3 inches from corner to form the angle reinforcement; fasten at perimeter edges only.

F. Place corner bead at external wall corners; fasten at outer edges of lath only.

G. Place base screeds at termination of plaster areas; secure rigidly in place.

H. Place 4 inch wide strips of metal lath centered over junctions of dissimilar backing materials. Secure rigidly in place.

I. Place lath vertically above each top corner and each side of door frames to 6 inches above ceiling line.

J. Place casing beads at terminations of plaster finish. Butt and align ends. Secure rigidly in place.

K. Place additional strip mesh diagonally at corners of lathed openings. Secure rigidly in place.

3.06 TOLERANCES

A. Maximum Variation from True Lines and Levels: 1/8 inch in 10 feet.

B. Maximum Variation from True Position: 1/8 inch.

END OF SECTION

SECTION 09 24 00
PORTLAND CEMENT PLASTERING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Portland cement plaster for installation over metal lath.

1.02 RELATED REQUIREMENTS

A. Section 09 22 36.23 - Metal Lath: Metal furring and lathing for plaster.

B. Section 09 90 00 - Painting and Coating.

1.03 REFERENCE STANDARDS

A. ASTM C150/C150M - Standard Specification for Portland Cement; 2012.

B. ASTM C206 - Standard Specification for Finishing Hydrated Lime; 2003 (Reapproved 2009).

C. ASTM C926 - Standard Specification for Application of Portland Cement-Based Plaster; 2014a.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittals procedures.

B. Product Data: Provide data on plaster materials, characteristics and limitations of products specified.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years documented experience.

1.06 MOCK-UP

A. Construct mock-up of exterior wall, 3 feet long by 4 feet wide, illustrating surface finish.

B. Locate where directed.

C. Mock-up may remain as part of the Work.

1.07 FIELD CONDITIONS

A. Do not apply plaster when substrate or ambient air temperature is under 50 degrees F or over 80 degrees F.

B. Maintain minimum ambient temperature of 50 degrees F during installation of plaster and until cured.

PART 2 PRODUCTS

2.01 PORTLAND CEMENT PLASTER ASSEMBLIES

A. Exterior Stucco: Portland cement plaster system, made of finish, brown, and scratch coat and reinforcing mesh.

2.02 PLASTER MATERIALS

A. Portland Cement, Aggregates, and Other Materials: In accordance with ASTM C926.

B. Premixed Base Coat: Mixture of cement, aggregate, and proprietary admixtures for scratch and brown coats, installed in accordance with ASTM C926.

C. Premixed Finish Coat: Same product as base coat.

D. Water: Clean, fresh, potable and free of mineral or organic matter that could adversely affect plaster.

2.03 METAL LATH

A. Metal Lath and Accessories: As specified in Section 09 22 36.23. Use metal lath as plaster base at soffits.

B. Beads, Screeds, and Joint Accessories: As specified in Section 09 22 36.23.

2.04 PLASTER MIXES

A. Over Metal Lath: Three-coat application, mixed and proportioned in accordance with manufacturer's instructions.

B. Premixed Plaster Materials: Mix in accordance with manufacturer's instructions.

C. Mix only as much plaster as can be used prior to initial set.

D. Mix materials dry, to uniform color and consistency, before adding water.

E. Protect mixtures from freezing, frost, contamination, and excessive evaporation.

F. Do not retemper mixes after initial set has occurred.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify the suitability of existing conditions before starting work.

B. Metal Lath and Accessories: Verify lath is flat, secured to substrate, and joint and surface perimeter accessories are in place.

C. Plumbing: Verify rain drains within soffit have been tested and approved

3.02 PLASTERING

A. Apply premixed plaster in accordance with manufacturer's instructions.

B. Apply plaster in accordance with ASTM C926.

C. Three-Coat Application Over Metal Lath:
   1. Apply first coat to a nominal thickness of 3/8 inch.
   2. Apply second coat to a nominal thickness of 3/8 inch.
   3. Apply finish coat to a nominal thickness of 1/8 inch.

D. Moist cure base coats.

E. Apply second coat immediately following initial set of first coat.

F. After curing, dampen previous coat prior to applying finish coat.

G. Finish Texture: Provide a consistent appearance; Match adjacent surfaces for seamless transition between new and existing surfaces

H. Avoid excessive working of surface. Delay troweling as long as possible to avoid drawing excess fines to surface.

I. Moist cure finish coat for minimum period of 48 hours.

END OF SECTION

SECTION 09 30 00

TILING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Tile for floor applications.

B. Tile for wall applications.

C. Cementitious backer board as tile substrate.

D. Coated glass mat backer board as tile substrate.

E. Ceramic accessories.

F. Ceramic trim.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast In Place Concrete.

B. Section 09 21 16 - Gypsum Board Assemblies: Tile backer board.

C. Section 22 40 00 - Plumbing Fixtures.

1.03 REFERENCE STANDARDS

A. ANSI A108/A118/A136.1 - American National Standard Specifications for the Installation of Ceramic Tile - Version; 2013.1.

B. ANSI A108.1A - American National Standard Specifications for Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar; 2013.1.

C. ANSI A108.1B - American National Standard Specifications for Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar; 2013.1.

D. ANSI A108.1C - Specifications for Contractors Option: Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Bed with Dry-Set or Latex-Portland Cement Mortar; 2013.1.

E. ANSI A108.4 - American National Standard Specifications for Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile-Setting Epoxy Adhesive; 2013.1.

F. ANSI A108.5 - American National Standard Specifications for Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar; 2013.1.

G. ANSI A108.6 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy; 2013.1.

H. ANSI A108.8 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant Furan Resin Mortar and Grout; 2013.1.

I. ANSI A108.9 - American National Standard Specifications for Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout; 2013.1.

J. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework; 2013.1.

K. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units; 2013.1.

L. ANSI A108.12 - American National Standard Specifications for Installation of Ceramic Tile with EGP (Exterior Glue Plywood) Latex-Portland Cement Mortar; 2013.1.

M. ANSI A108.13 - American National Standard Specifications for Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone; 2013.1.

N. ANSI A118.1 - American National Standard Specifications for Dry-Set Cement Mortar; 2013.1.

O. ANSI A118.4 - American National Standard Specifications for Modified Dry-Set Cement Mortar; 2013.1.

P. ANSI A118.5 - American National Standard Specifications for Chemical Resistant Furan Mortars and Grouts for Tile Installation; 2013.1.

Q. ANSI A118.6 - American National Standard Specifications for Standard Cement Grouts for Tile Installation; 2013.1.

R. ANSI A118.8 - American National Standard Specifications for Modified Epoxy Emulsion Mortar/Grout; 1999 (R2005).

S. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units; 2013.1.

T. ANSI A136.1 - American National Standard Specifications for Organic Adhesives for Installation of Ceramic Tile; 2013.1.

U. ANSI A137.1 - American National Standard Specifications for Ceramic Tile - Version; 2013.1.

V. ASTM C1178/C1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel; 2013.

W. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation - Version; 2013.1.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.

C. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, ceramic accessories, and setting details. Prepare tile slope plan with heights of drains, maximum and minimum slopes and maximum and minimum grout thickness.

D. Samples: Mount tile and apply grout on two plywood panels, minimum 18 x 18 inches in size illustrating pattern, color variations, and grout joint size variations.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

F. Maintenance Data: Include recommended cleaning methods, cleaning materials, stain removal methods, and polishes and waxes.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Tile: 10 square feet of each size, color, and surface finish combination.

1.05 MOCK-UP

A. See Section 01 40 00 - Quality Requirements, for general requirements for mock-up.

B. Construct tile mock-up where indicated on the drawings, incorporating all components specified for the location.
   1. Minimum size of mock-up is indicated on the drawings.
   2. Approved mock-up may remain as part of the Work.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.07 FIELD CONDITIONS

A. Do not install adhesives in an unventilated environment.

B. Maintain ambient and substrate temperature of 50 degrees F during installation of mortar materials.

PART 2 PRODUCTS

2.01 TILE

A. Glazed Body Match Porcelain Floor Tile Type CT: ANSI A137.1, and as follows:
   1. Perspective Pure manufactured by Emser Tile or approved equivalent product.

2. Moisture Absorption: 0 to 0.5 percent.
3. Size and Shape: 12 inches x 24 inches.
4. Edges: Square.
5. Thickness: 3/8 inch
6. Color(s): To be selected from manufacturer's standard range..
7. Trim Units: Matching surface bullnose shapes in sizes coordinated with field tile.
    a. Products:

B. Glazed Body Match Porcelain Wall Tile Type WT: ANSI A137.1, and as follows:
1. [Perspective Pure] manufactured by [Emser Tile] or approved equivalent product.
    a. Size and Shape: 12 inch x 24 inch.
    b. Edges: Square. (Top row is bullnose)
    c. Thickness: 3/8 inch
    d. Color(s): To be selected from manufacturer's standard range.
    e. Trim Units: Matching bullnose and coved base shapes in sizes coordinated with field tile.
    f. Trim Products:
        1) _____.

2.02 ADHESIVE MATERIALS

A. Manufacturers: Any that meet the requirements of this section.
1. Substitutions: See Section 01 6000 - Product Requirements.

B. Organic Adhesive: ANSI A136.1, thinset bond type; use Type 1 in areas subject to prolonged moisture exposure.

C. Tile Setting Adhesive: Elastomeric, waterproof, liquid applied.

2.03 MORTAR MATERIALS

A. Manufacturer: Any that meet the requirements of this section.
1. Substitutions: See Section 01 6000 - Product Requirements.

B. Mortar Bed Materials: Portland cement, sand, latex additive, and water.

C. Mortar Bond Coat Materials:
1. Latex-Portland Cement Type: ANSI A118.4.

2.04 GROUT MATERIALS

A. Manufacturers:
1. TEC Specialty Construction Brands.
2. Substitutions: See Section 01 60 00 - Product Requirements.

B. Epoxy Grout: ANSI A118.3, modified epoxy emulsion grout.
1. Color: To be selected from manufacturer's standard colors

2.05 SEALER MATERIALS

A. Product: Sealers Choice Gold by Aqua Mix.

B. Seal tile before and after grouting.

2.06 ACCESSORY MATERIALS

A. Backer Board: Cementitious type complying with ANSI A118.9; high density, glass fiber reinforced, 1/2 inch thick; 2 inch wide coated glass fiber tape for joints and corners.

B. Backer Board: Coated glass mat type complying with ASTM C1178/C1178M; inorganic fiberglass mat on both surfaces and integral acrylic coating vapor retarder.

C. Mesh Tape: 2-inch wide self-adhesive fiberglass mesh tape.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.

3.02 PREPARATION

A. Protect surrounding work from damage.

B. Vacuum clean surfaces and damp clean.

C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.

D. Install backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of setting material to a feather edge.

3.03 INSTALLATION - GENERAL

A. Install tile and grout in accordance with applicable requirements of ANSI A108.1A thru A108.13, manufacturer's instructions, and TCNA (HB) recommendations.

B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.

C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.

D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make joints watertight, without voids, cracks, excess mortar or excess grout.

E. Form internal angles square and external angles bullnosed.

F. Install ceramic accessories rigidly in prepared openings.

G. Sound tile after setting. Replace hollow sounding units.

H. Keep control and expansion joints free of mortar, grout, and adhesive.

I. Allow tile to set for a minimum of 48 hours prior to grouting.

J. Prior to grouting, allow installation to completely cure; minimum of 48 hours.

K. Grout tile joints unless otherwise indicated. Use standard grout unless otherwise indicated.

L. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

M. Seal tile before and after grouting.

3.04 INSTALLATION - FLOORS - THIN-SET METHODS

A. Over interior concrete substrates, install in accordance with TCNA (HB) Method F113, dry-set or latex-Portland cement bond coat, with epoxy grout, unless otherwise indicated.

3.05 INSTALLATION - WALL TILE

A. Over coated glass mat backer board on studs, install in accordance with TCNA (HB) Method W245. Provide epoxy grout

3.06 CLEANING

A. Clean tile and grout surfaces.

3.07 PROTECTION

A. Do not permit traffic over finished floor surface for 4 days after installation.

END OF SECTION

SECTION 09 51 00
ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Suspended metal grid ceiling system.

B. Acoustical units.

1.02 RELATED REQUIREMENTS

A. Section 26 51 00 - Interior Lighting: Light fixtures 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.

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 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate grid layout and related dimensioning.

C. Product Data: Provide data on suspension system components.

D. Samples: Submit two samples 12 by 12 inch in size illustrating material and finish of acoustical units.

E. Seismic Bracing: If required by the City of Salem, then provide calculations and seismic bracing details for acoustic ceiling sealed by an Oregon Licensed Engineer.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Acoustical Units: Quantity equal to 5 percent of total installed.

1.06 QUALITY ASSURANCE

A. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

B. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.07 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 Panels:
   1. Armstrong World Industries, Inc: www.armstrong.com.
   2. Acoustic Ceiling Products, Inc: www.acpideas.com.

3. CertainTeed Corporation: www.certainteed.com.
4. USG: www.usg.com.
5. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ACOUSTICAL UNITS

A. Acoustical Units - General: ASTM E1264, Class A.

B. Acoustical Tile Type Match Armstrong's Dune Second Look: Painted mineral fiber, ASTM E1264 Type III, with the following characteristics:
1. Size: 24 by 24 inches.
2. Thickness: 5/8 inches.

2.03 SUSPENSION SYSTEM(S)

A. Manufacturers: (Basis of Design)
1. Donn; Product DX
2. Substitutions: See Section 01 6000 - Product Requirements.

B. 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. Construction: Double web.
3. 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. Acoustical Insulation: ASTM C665, friction fit type, unfaced batts.
1. Thickness: 3 inch.

D. Gasket For Perimeter Moldings: Closed cell rubber sponge tape.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that layout of hangers will not interfere with other work.

3.02 INSTALLATION - SUSPENSION SYSTEM

A. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, and manufacturer's instructions and as supplemented in this section.

B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

C. Locate system on room axis according to reflected plan.

D. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.

E. Provide hanger clips during steel deck erection. Provide additional hangers and inserts as required.

F. 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.

G. 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.

H. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.

I. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.

J. Do not eccentrically load system or induce rotation of runners.

K. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
   1. Install with continuous gasket at sound rated walls
   2. Use longest practical lengths.
   3. Overlap and rivet corners.

3.03 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. Cut to fit irregular grid and perimeter edge trim.
   2. Make field cut edges of same profile as factory edges.

G. Where round obstructions occur, provide preformed closures to match perimeter molding.

H. Lay acoustical insulation for a distance of 24 inches either side of acoustical partitions . at sound rated

3.04 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.

3.05 SCHEDULE

A. Provide acoustic ceiling tile as indicated on the drawings

END OF SECTION

SECTION 09 65 00
RESILIENT FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Resilient LVT sheet flooring

B. Resilient VCT tile flooring.

C. Sheet Vinyl Flooring

D. Resilient base.

E. Installation accessories.

1.02 REFERENCE STANDARDS

A. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2014c.

B. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2011.

C. ASTM F970 - Standard Test Method for Static Load Limit; 2007 (Reapproved 2011).

D. ASTM F1066 - Standard Specification for Vinyl Composition Floor Tile; 2004 (Reapproved 2010)e1.

E. ASTM F1303 - Standard Specification for Sheet Vinyl Floor Covering with Backing; 2004 (Reapproved 2014).

F. ASTM F1700 - Standard Specification for Solid Vinyl Floor Tile; 2013a.

G. ASTM F1861 - Standard Specification for Resilient Wall Base; 2008 (Reapproved 2012)e1.

H. ASTM F1913 - Standard Specification for Vinyl Sheet Floor Covering Without Backing; 2004 (Reapproved 2010).

I. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; National Fire Protection Association; 2011.

J. RFCI (RWP) - Recommended Work Practices for Removal of Resilient Floor Coverings; Resilient Floor Covering Institute; October 2011.

1.03 SUBMITTALS

A. See Section 01 30 00 - 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. Shop Drawings: Indicate seaming plan.

D. Selection Samples: Submit manufacturer's complete set of color samples for Architect's initial selection.

E. Verification Samples: Submit two samples, 6 by 6 inch in size illustrating color and pattern for each resilient flooring product specified.

F. Certification: Prior to installation of flooring, submit written certification by flooring manufacturer and adhesive manufacturer that condition of sub-floor is acceptable.

G. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Flooring Material: 100 square feet of each type and color.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.

B. Store all materials off of the floor in an acclimatized, weather-tight space.

C. Maintain temperature in storage area between 55 degrees F and 90 degrees F.

D. Protect roll materials from damage by storing on end.

E. Do not double stack pallets.

1.05 FIELD CONDITIONS

A. 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 TILE FLOORING (LVT)

A. Tile Flooring - Type LVT: Homogeneous without backing, with color and pattern throughout full thickness.
   1. Minimum Requirements: Comply with ASTM F1913.
   2. Total Thickness and Wear Layer Thickness:.096 inch nominal.
   3. Wear Layer: Urethane Wearlayer with aluminum oxide
   4. Certification: FloorScore
   5. Integral coved base with cap strip.
   6. Pattern: Solid color.
   7. Manufacturers:
      a. Mannington Commercial; Product: Spacia.
         1) Color: Concrete SS5S3608
         2) Size: 18 x 30
      b. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 VINYL SHEET FLOORING - TYPE SV:

A. COLOR AND PATTERN THROUGHOUT WEAR LAYER THICKNESS, WITH BACKING.

B. Minimum Requirements: Comply with ASTM F1303, Type II, with Class A fibrous backing.

C. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E 648 or NFPA 253.

D. Wear Layer Thickness: 0.050 inch minimum.

E. Total Thickness: 0.080 inch minimum.

F. Sheet Width: 72 inch minimum.

G. Static Load Resistance: 125 psi minimum, when tested as specified in ASTM F970.

H. Heat welded seams.
   1. Vinyl Welding Rod: Solid vinyl bead produced by manufacturer of vinyl flooring for heat welding seams, in color matching field color.

I. Integral coved base with cap strip.

J. Pattern: Solid color.

K. Manufacturers:
   1. Armstrong.

L. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 TILE FLOORING (VCT)

A. Vinyl Composition Tile: Homogeneous, with color extending throughout thickness.

1. Minimum Requirements: Comply with ASTM F1066, of Class corresponding to type specified.
2. Size: 12 by 12 inch.
3. Thickness: 0.125 inch.
4. Pattern: Solid color.
5. Manufacturers:
    a. Armstrong World Industries, Inc; Product: Standard Excelon: www.armstrong.com.
    b. Substitutions: See Section 01 60 00 - Product Requirements.

2.04 RESILIENT BASE

A. Resilient Base: ASTM F1861, Type TS rubber, vulcanized thermoset; top set Style B, Cove.
1. Height: 4 inch.
2. Thickness: 0.125 inch thick.
3. Finish: Satin.
4. Color: Color as selected from manufacturer's standards.

2.05 ACCESSORIES

A. Primers, Adhesives, and Seaming Materials: Waterproof; types recommended by flooring manufacturer.

B. Filler for Coved Base: Plastic.

C. Sealer and Wax: Types recommended by flooring manufacturer.

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. Cementitious Sub-floor Surfaces: Verify that substrates are dry enough and ready for resilient flooring installation by testing for moisture and pH.
1. Test in accordance with ASTM F710.
2. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.

3.02 PREPARATION

A. Remove existing resilient flooring and flooring adhesives; follow the recommendations of RFCI Recommended Work Practices for Removal of Resilient Floor Coverings.

B. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

C. 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.

D. Prohibit traffic until filler is cured.

E. Clean substrate.

3.03 INSTALLATION

A. Starting installation constitutes acceptance of sub-floor conditions.

B. Install in accordance with manufacturer's instructions.

C. Spread only enough adhesive to permit installation of materials before initial set.

D. Fit joints tightly.

E. Set flooring in place, press with heavy roller to attain full adhesion.

F. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.

G. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.

H. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

3.04 SHEET FLOORING

A. Lay flooring with joints and seams parallel to longer room dimensions, to produce minimum number of seams. Lay out seams to avoid widths less than 1/3 of roll width; match patterns carefully at seams.

B. Double cut sheet at seams.

C. Lay flooring with tightly butted seams, without any seam sealer unless otherwise indicated.

D. Finish seams in sheet vinyl Type SV by heat welding.

E. Coved Base: Install as detailed on drawings, using coved base filler as backing at floor to wall junction. Extend sheet flooring vertically to height indicated, and cover top edge with metal cap strip.

3.05 TILE FLOORING

A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless manufacturer's instructions say otherwise.

3.06 RESILIENT BASE

A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches 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.

D. Scribe and fit to door frames and other interruptions.

3.07 CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damage.

B. Clean in accordance with manufacturer's instructions.

3.08 PROTECTION

A. Prohibit traffic on resilient flooring for 48 hours after installation.

END OF SECTION

SECTION 09 68 13

TILE CARPETING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Carpet tile, fully adhered.

1.02 RELATED REQUIREMENTS

A. Section 09 65 00 Resilient Flooring: Rubber Base

1.03 REFERENCE STANDARDS

A. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2011.

B. CRI (CIS) - Carpet Installation Standard; Carpet and Rug Institute; 2011.

1.04 SUBMITTALS

A. See Section 01 30 00 - 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.

D. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

E. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Carpet Tiles: Quantity equal to 5 percent of total installed of each color and pattern installed.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Tile Carpeting:
   1. Mannington Commercial

2.02 MATERIALS

A. Tile Carpeting: _____, manufactured in one color dye lot.
   1. Product: graffiti II manufactured by Mannington Commercial.
   2. Construction: Tip Sheared Pattern Loop
   3. Color: To be Selected
   4. Tile Size: 24 inch x 24 inch inch, nominal.
   5. Thickness:.122 inch.
   6. Gage: 5/64 inch.
   7. Stitches: 10.5 per inch.
   8. Pile Weight: 27 oz/sq yd.

2.03 ACCESSORIES

A. Edge Strips: Embossed aluminum, _____ color.

B. Adhesives:

C. Carpet Tile Adhesive: Recommended by carpet tile manufacturer; releasable type.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that sub-floor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive carpet tile.

C. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to sub-floor surfaces.

D. Cementitious Sub-floor Surfaces: Verify that substrates are dry enough and ready for flooring installation by testing for moisture and pH.
   1. Test in accordance with ASTM F710.
   2. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.

3.02 PREPARATION

A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

B. Remove sub-floor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with sub-floor filler.

C. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.

D. Vacuum clean substrate.

3.03 INSTALLATION

A. Starting installation constitutes acceptance of sub-floor conditions.

B. Install carpet tile in accordance with manufacturer's instructions and CRI (CIS).

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 alternating to next unit, set in a brick ashlar installation method.

F. Locate change of color or pattern between rooms under door centerline.

G. Fully adhere carpet tile to substrate.

H. Trim carpet tile neatly at walls and around interruptions.

I. Complete installation of edge strips, concealing exposed edges.

3.04 CLEANING

A. Remove excess adhesive without damage, from floor, base, and wall surfaces.

B. Clean and vacuum carpet surfaces.

END OF SECTION

SECTION 09 90 00

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, including the following:
   1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
   2. Mechanical and Electrical:
      a. In finished areas, paint all insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment, 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. Paint interior surfaces of air ducts and convector and baseboard heating cabinets that are visible through grilles and louvers with one coat of flat black paint to visible surfaces.

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. Concrete masonry
   7. Glass.
   8. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

A. Section 05 50 00 - Metal Fabrications: Shop-primed items.

B. Section 32 17 23.13 - Painted Pavement Markings: Painted pavement markings.

1.03 DEFINITIONS

A. Conform to ASTM D16 for interpretation of terms used in this section.

1.04 REFERENCE STANDARDS

A. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2012.

B. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials; 2007.

C. SSPC (PM1) - Good Painting Practice: SSPC Painting Manual, Vol. 1; Society for Protective Coatings; Fourth Edition.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide complete list of all products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").

2. MPI product number (e.g. MPI #47).
3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
4. Manufacturer's installation instructions.

C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
1. Where sheen is specified, submit samples in only that sheen.
2. Provide up to 3 draw downs for each material and each color for color selection purposes

D.

E. Manufacturer's Instructions: Indicate special surface preparation procedures.

F. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and coated surfaces, and color samples of each color and finish used.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 01 60 00 - Product Requirements, for additional provisions.
2. Extra Paint and Coatings: 1 gallon of each color; store where directed.
3. Label each container with color in addition to the manufacturer's label.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum five years documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum five years experience.

1.07 MOCK-UP

A. See Section 01 40 00 - Quality Requirements, for general requirements for mock-up.

B. Provide panel, 10 feet long by 10 feet wide, illustrating each coating color, texture, and finish.

C. Mock - up of paint over pre-primed metal. Test for flash rusting

D. Locate where directed.

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

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. Base Manufacturer: Rodda Paint.
2. Other Manufacturers:
a. Duron, Inc: www.duron.com.
b. Benjamin Moore & Co: www.benjaminmoore.com.
c. PPG Architectural Finishes, Inc: www.ppgaf.com.
d. Sherwin-Williams Company: www.sherwin-williams.com.

C. Primer Sealers: Same manufacturer as top coats.

D. Substitutions: See Section 01 60 00 - 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 (1 Coat): 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.
1. Exterior Sheet Metal: DTM Acrylic Primer Product: Rodda's First Coat primer
2. Ferrous Metal / Galvanized Steel (Shop primed and unprimed): Polyamide Epoxy Coating.
3. Gypsum Board (PT) (New only):Latex enamel: Product: Rodda's Scottseal primer
4. Gypsum Board and Veneer Plaster in wet /moist environments(EP): Waterborne Epoxy Primer Product: Rodda's Ecologic Epoxy

C. Finishes (Existing and New): (2 Coats)
1. Sheet metal: DTM Acrylic Semi Gloss
2. Ferrous Metal / Galvanized Steel (Shop primed and unprimed): Aliphatic Acrylic Urethane Product: Rodda's Polycoat HS
3. Gypsum Board (PT): Rodda's Master Painter Interior- Satin
4. Gypsum Board and Veneer Plaster (EP) in wet / moist environments: Waterborne Epoxy Product: Rodda's Ecologic Epoxy
   a. Walls: Semi gloss
   b. Ceilings: Gloss

2.03 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. Do not begin application of coatings until substrates have been properly prepared.

B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

D. Test shop-applied primer for compatibility with subsequent cover materials. Test for:
1. Adhesion
2. Thickness
3. Flash rusting for pre-primed steel

E. 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. Plaster and Stucco: 12 percent.
3. Interior 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 repair existing coatings that exhibit surface defects.

D. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.

E. Seal surfaces that might cause bleed through or staining of topcoat.

F. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

G. Gypsum Board Surfaces to be Painted: Fill minor defects with filler compound. Spot prime defects after repair.

H. Plaster Surfaces to be Painted: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.

I. Galvanized Surfaces to be Painted: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.

J. 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).

K. 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 or power tool 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.

L. 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.

3.03 APPLICATION

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

B. Apply products in accordance with manufacturer's instructions.

C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

D. Apply each coat to uniform appearance.

E. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as necessary for complete hide.

F. Sand wood and metal 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.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for general requirements for field inspection.

B. Inspect and test questionable coated areas in accordance with manufacturer's printed instructions.

3.05 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.06 PROTECTION

A. Protect finished coatings until completion of project.

B. Touch-up damaged coatings after Substantial Completion.

3.07 SCHEDULE - PAINT SYSTEMS

A. Finish of all exposed surfaces includes but is not limited to:
   1. Gypsum Board - New: Finish all surfaces exposed to view.
   2. Gypsum Board Surface, Previously Painted - Existing: Finish all surfaces exposed to vies
   3. Steel Doors and Frames (Existing): Finish all surfaces exposed to view.
   4. Steel Fabrications: Finish all surfaces exposed to view.
   5. Galvanized Steel: Finish all surfaces exposed to view.
   6. Shop-Primed Metal Items: Finish all surfaces exposed to view.
   7. Exposed piping and duct work:
   8. Pipe and Duct Insulation Jackets:

3.08 SCHEDULE - COLORS

A. To be Selected

END OF SECTION

SECTION 10 11 01
VISUAL DISPLAY BOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Markerboards.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Blocking and supports.

B. Section 06 41 00 - Architectural Casework: Case work to enclose a visual display board

C. Section 09 21 16 - Gypsum Board Assemblies: Concealed supports in metal stud walls.

1.03 REFERENCE STANDARDS

A. ANSI A208.1 - American National Standard for Particleboard; 2009.

B. ASTM A424/A424M - Standard Specification for Steel, Sheet, for Porcelain Enameling; 2009a.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's data on markerboard, trim, and accessories.

C. Shop Drawings: Indicate wall elevations, dimensions, joint locations, special anchor details.

D. Samples: Submit color charts for selection of color and texture of markerboard and trim.

E. Test Reports: Show conformance to specified surface burning characteristics requirements.

F. Manufacturer's printed installation instructions.

G. Maintenance Data: Include data on regular cleaning, stain removal .

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.06 WARRANTY

A. See Section 01 78 00 - Closeout Submittals - Closeout Submittals, for additional warranty requirements.

B. Provide five year warranty for markerboard to include warranty against discoloration due to cleaning, crazing or cracking, and staining.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Visual Display Boards:
   1. Claridge Products and Equipment, Inc; Mod2 Unit: www.claridgeproducts.com.
   2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 VISUAL DISPLAY BOARDS

A. Markerboards: Porcelain enamel on steel, laminated to core.
   1. Color: White.
   2. Steel Face Sheet Thickness: 24 gage, 0.0239 inch .
   3. Core: Particleboard, manufacturer's standard thickness, laminated to face sheet.
   4. Backing: Aluminum foil, laminated to core.
   5. Height: 48 inches.
   6. Length: 8 feet, in one piece.
   7. Frame: Extruded aluminum, with concealed fasteners.
   8. Frame Finish: Anodized, natural.
   9. Accessories: Provide chalk tray and map rail.

2.03 MATERIALS

A. Porcelain Enameled Steel Sheet: ASTM A424/A424M, Type I, Commercial Steel, with fired-on vitreous finish.

B. Particleboard: ANSI A208.1; wood chips, set with waterproof resin binder, sanded faces.

C. Foil Backing: Aluminum foil sheet, 0.005 inch thick.

2.04 ACCESSORIES

A. Map Rail: Extruded aluminum, manufacturer's standard profile, with cork insert and runners for accessories; 1 inch wide overall, full width of frame.

B. Temporary Protective Cover: Sheet polyethylene, 8 mil thick.

C. Chalk Tray: Aluminum, manufacturer's standard profile one piece full length of chalkboard, molded ends; concealed fasteners, same finish as frame.

D. Mounting Brackets: Concealed.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that internal wall blocking is ready to receive work and positioning dimensions are as indicated on shop drawings.

3.02 INSTALLATION

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

B. Install with top of chalk tray at 30 inches above finished floor.

C. Secure units level and plumb.

3.03 CLEANING

A. Clean board surfaces in accordance with manufacturer's instructions.

B. Cover with protective cover, taped to frame.

C. Remove temporary protective cover at date of Substantial Completion.

3.04 SCHEDULE

A. Conference Rooms: Provide one marker board in each of five First Floor conference / meeting rooms

B. Obtain exact location of marker boards prior to wall framing

END OF SECTION

SECTION 10 14 00

SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Room and door signs.

1.02 REFERENCE STANDARDS

A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.

B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

C. ICC A117.1 - Accessible and Usable Buildings and Facilities; International Code Council; 2009 (ANSI).

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.

C. Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.
   1. When room numbers to appear on signs differ from those on the drawings, include the drawing room number on schedule.
   2. When content of signs is indicated to be determined later, request such information from Owner through Architect at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
   3. Submit for approval by Owner through Architect prior to fabrication.

D. Samples: Submit two samples of each type of sign, of size similar to that required for project, illustrating sign style, font, and method of attachment.

E. Selection Samples: Where colors are not specified, submit two sets of color selection charts or chips.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Package signs as required to prevent damage before installation.

B. Package room and door signs in sequential order of installation, labeled by floor or building.

C. Store tape adhesive at normal room temperature.

1.06 FIELD CONDITIONS

A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.

B. Maintain this minimum temperature during and after installation of signs.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Flat Signs:
   1. Best Sign Systems, Inc; Product Restroom Braille Signs: www.bestsigns.com.
   2. Seton Identification Products; Product Restroom Braille Signs: www.seton.com/aec.
   3. Substitutions: See Section 01 60 00 - Product Requirements.

B. Dimensional Letter Signs:

1. Cosco Industries; Cast Aluminum: www.coscoarchitecturalsigns.com.
2. Inpro; S600-060: www.inprocorp.com.
3. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 SIGNAGE APPLICATIONS

A. Accessibility Compliance: Signs are required to comply with ADA Standards and ICC A117.1 and applicable building codes, unless otherwise indicated; in the event of conflicting requirements, comply with the most comprehensive and specific requirements.

B. Room and Door Signs: Provide a sign for every restroom / shower doorway, whether it has a door or not, not including corridors, lobbies, and similar open areas.
   1. Sign Type: Flat signs with engraved panel media as specified.
   2. Provide "tactile" signage, with letters raised minimum 1/32 inch and Grade II braille.
   3. Character Height: 5/8 inch.
   4. Sign Height: 8 inches, unless otherwise indicated.
   5. Rest Rooms: Identify with pictograms, room numbers to be determined later, and braille. Restroom signs as follows
      a. "MEN" and "WOMEN" where occurs
      b. "UNISEX" where occurs

2.03 SIGN TYPES

A. Flat Signs: Signage media without frame.
   1. Edges: Square.
   2. Corners: Square.
   3. Wall Mounting of One-Sided Signs: Tape adhesive.

B. Color and Font: Unless otherwise indicated:
   1. Character Font: Helvetica, Arial, or other sans serif font.
   2. Character Case: Upper case only.
   3. Background Color: Clear.
   4. Character Color: Contrasting color.

2.04 TACTILE SIGNAGE MEDIA

A. Engraved Panels: Laminated colored plastic; engraved through face to expose core as background color:
   1. Total Thickness: 1/16 inch.

2.05 ACCESSORIES

A. Tape Adhesive: Double sided tape, permanent adhesive.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install neatly, with horizontal edges level.

C. Locate signs where indicated:
   1. Room and Door Signs: Locate on wall at latch side of door with centerline of sign at 60 inches above finished floor.
   2. If no location is indicated obtain Owner's instructions.

D. Protect from damage until Substantial Completion; repair or replace damage items.

END OF SECTION

SECTION 10 21 13.13
METAL TOILET COMPARTMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal toilet compartments.

B. Urinal screens.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Blocking and supports.

B. Section 10 28 00 - Toilet, Bath, and Laundry Accessories.

1.03 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2013.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the work with placement of support framing and anchors in walls and ceilings.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall, floor, and ceiling supports, door swings.

C. Product Data: Provide data on panel construction, hardware, and accessories.

D. Samples: Submit two samples of partition panels, 6 x 6 inch in size illustrating panel finish, color, and sheen.

E. Manufacturer's Installation Instructions: Indicate special procedures.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Toilet Compartments:
   1. Accurate Partitions
   2. Bobrick
   3. Substitutions: Section 01 60 00 - Product Requirements.

2.02 MATERIALS

2.03 COMPONENTS

A. Toilet Compartments: Baked Enamel steel, floor-to-ceiling.

B. Doors, Panels, and Pilasters: Sheet steel faces, pressure bonded to sound deadening core, formed and closed edges; corners made with corner clips or mitered, welded, and ground smooth.
   1. Panel Faces: 20 gage, 0.0359 inch.
   2. Door Faces: 22 gage, 0.0299 inch.
   3. Pilaster Faces: 20 gage, 0.0359 inch.
   4. Reinforcement: 12 gage, 0.1046 inch.
   5. Internal Reinforcement: Provide in areas of attached hardware and fittings. Mark locations of reinforcement for partition mounted washroom accessories.

C. Door and Panel Dimensions:
   1. Thickness: 1 inch.
   2. Door Width: 24 inch.
   3. Door Width for Handicapped Use: 36 inch, out-swinging.
   4. Height: 58 inch.

D. Urinal Screens: Wall mounted with two panel brackets, and floor-to-ceiling vertical upright consisting of pilaster anchored to floor and ceiling.

2.04 ACCESSORIES

A. Pilaster Shoes: Formed chromed steel with polished finish, 3 inch high, concealing floor fastenings.

B. Head Rails: Hollow stainless steel tube, 1 by 1-5/8 inch size, with anti-grip strips and cast socket wall brackets.

C. Brackets: Polished stainless steel.

D. Attachments, Screws, and Bolts: Stainless steel, tamper proof type.

E. Hardware: Polished stainless steel:
   1. Pivot hinges, gravity type, adjustable for door close positioning; two per door.
   2. Nylon bearings.
   3. Thumb turn or sliding door latch with exterior emergency access feature.
   4. Door strike and keeper with rubber bumper; mounted on pilaster in alignment with door latch.
   5. Coat hook with rubber bumper; one per compartment, mounted on door.
   6. Provide door pull for outswinging doors.

2.05 FINISHING

A. Baked Enamel Steel Compartments: Clean, degrease, and neutralize. Follow immediately with a phosphatizing treatment, prime coat and two finish coats baked enamel.

B. Color: As selected from manufacturer's standard colors.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that field measurements are as indicated.

C. Verify correct spacing of and between plumbing fixtures.

D. Verify correct location of built-in framing, anchorage, and bracing.

3.02 INSTALLATION

A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.

B. Maintain 3/8 to 1/2 inch space between wall and panels and between wall and end pilasters.

C. Attach panel brackets securely to walls using anchor devices.

D. Attach panels and pilasters to brackets. Locate head rail joints at pilaster center lines.

E. Field touch-up of scratches or damaged enamel finish will not be permitted. Replace damaged or scratched materials with new materials.

3.03 TOLERANCES

A. Maximum Variation From True Position: 1/4 inch.

B. Maximum Variation From Plumb: 1/8 inch.

3.04 ADJUSTING

A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch.

B. Adjust hinges to position doors in partial opening position when unlatched. Return out swinging doors to closed position.

C. Adjust adjacent components for consistency of line or plane.

END OF SECTION

SECTION 10 22 26.33
FOLDING PANEL PARTITIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Folding panel partitions.

B. Ceiling track, ceiling guards, and operating hardware.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Wood blocking and track support shimming.

1.03 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2014.

B. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009.

C. ASTM E413 - Classification for Rating Sound Insulation; 2010.

D. ASTM E557 - Standard Guide for Architectural Design and Installation Practices for Sound Isolation between Spaces Separated by Operable Partitions; 2012.

E. ASTM E596 - Standard Test Method for Laboratory Measurement of Noise Reduction of Sound-Isolating Enclosures; 1996 (Reapproved 2009).

F. ASTM F793 - Standard Classification of Wallcovering by Use Characteristics; 2010a.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on partition materials, operation, hardware and accessories, track switching components, and colors and finishes available.

C. Shop Drawings: Indicate opening sizes, track layout, details of track and required supports, static and dynamic loads, adjacent construction and finish trim, and stacking depth.

D. Samples for Selection: Submit two samples of full manufacturer's color range for selection of colors.

E. Samples for Review: Submit two samples of surface finish, 12 by 12 inches size, illustrating quality, colors selected, texture, and weight.

F. Certificates: Certify that partition system meets or exceeds specified acoustic requirements.

G. Manufacturer's Instructions: Indicate special procedures, perimeter conditions requiring special attention, and installation sequence.

H. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods. Describe cleaning materials detrimental to finish surfaces and hardware finish.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified this section with minimum five years of documented experience.

B. Installer Qualifications: Company specializing in performing work of this section with minimum three years of experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design: Modernfold; Model 932

B. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 COMPONENTS

A. Operable Panel Partition: Center opening; paired panels; center stacking; manually operated.

B. Panel Finish: Fabric

C. Panel Frame: Welded steel

D. Skin / Face: MDF

E. Track Options: #14

F. Bottom Seal: 2 inch automatic

G. STC: 50

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that required utilities are available, of the correct characteristics, in proper location, and ready for use.

C. Verify track supports are laterally braced and will permit track to be level within 1/4 inch of required position and parallel to the floor surface.

D. Verify floor flatness of 1/8 inch in 10 feet, non-cumulative.

E. Verify wall plumbness of 1/8 inch in 10 feet, non-cumulative.

3.02 INSTALLATION

A. Install partition in accordance with manufacturer's instructions and ASTM E557.

B. Fit and align partition assembly and pocket doors level and plumb.

C. Lubricate moving components.

3.03 ADJUSTING

A. Adjust partition assembly to provide smooth operation from stacked to full open position. Do not over-compress acoustic seals.

B. Visually inspect partition in full extended position for light leaks to identify a potential acoustical leak.

C. Adjust partition assembly to achieve lightproof seal.

3.04 CLEANING

A. Clean finish surfaces and partition accessories.

3.05 CLOSEOUT ACTIVITIES

A. Demonstrate operation of partition and identify potential operational problems.

3.06 SCHEDULES

A. Location: As indicated

END OF SECTION

SECTION 10 28 00

TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Accessories for toilet rooms.

B. Electrically operated paper towel dispensers.

C. Grab bars.

1.02 RELATED REQUIREMENTS

A. Section 06 41 00 - Rough Carpentry: Concealed supports for accessories, including in wall framing and plates and above ceiling framing.

B. Section 10 21 13.13 - Metal Toilet Compartments.

1.03 REFERENCE STANDARDS

A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.

B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

C. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2014e1.

D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2013.

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

F. ASTM B456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium; 2011e1.

G. ASTM C1036 - Standard Specification for Flat Glass; 2011e1.

H. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2012.

I. ASTM F2285 - Standard Consumer Safety Performance Specification for Diaper Changing Tables for Commercial Use; 2004 (Reapproved 2010).

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with the placement of internal wall reinforcement, concealed ceiling supports, and reinforcement of toilet partitions to receive anchor attachments.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Samples: Submit two samples of each accessory, illustrating color and finish.

C. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design: _____.

B. Other Acceptable Manufacturers:
   1. A & J Washroom Accessories Inc: www.ajwashroom.com.
   2. American Specialties, Inc: www.americanspecialties.com.
   3. Bradley Corporation: www.bradleycorp.com.
   4. Substitutions: Section 01 60 00 - Product Requirements.

2.02 MATERIALS

A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.

B. Keys: Provide two keys for each accessory to Owner; master key lockable accessories.

C. Stainless Steel Sheet: ASTM A666, Type 304.

D. Stainless Steel Tubing: ASTM A269/A269M, Type 304 or 316.

E. Mirror Glass: Tempered safety glass, ASTM C1048; and ASTM C1036 Type I, Class 1, Quality Q2, with silvering as required.

F. Adhesive: Two component epoxy type, waterproof.

G. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.

2.03 FINISHES

A. Stainless Steel: No. 4 Brushed finish, unless otherwise noted.

B. Back paint components where contact is made with building finishes to prevent electrolysis.

2.04 TOILET ROOM ACCESSORIES

A. Toilet Paper Dispenser: Double roll, surface mounted bracket type, chrome-plated zinc alloy brackets, spindleless type for tension spring delivery designed to prevent theft of tissue roll.
   1. Attached Purse Shelf: 0.03 inch satin finished stainless steel, with rolled or formed edge at front.
   2. Product: _____ manufactured by _____.

B. Paper Towel Dispenser: Folded paper type, stainless steel, surface-mounted, with viewing slots on sides as refill indicator and tumbler lock.
   1. Capacity: 300 C-fold minimum.
   2. Product: 3949 manufactured by Bobrick.

C. Soap Dispenser: Liquid soap dispenser, deck-mounted on lavatory, with polyethylene container concealed below deck; piston and 4 inch spout of stainless steel with bright polished finish; chrome-plated deck escutcheon.
   1. Minimum Capacity: 16 ounces.
   2. Product: 826-20 manufactured by Bobrick.

D. Mirrors: Stainless steel framed, 1/4 inch thick tempered safety glass; ASTM C1048.
   1. Size: As indicated on drawings.
   2. Frame: 0.05 inch angle shapes, with mitered and welded and ground corners, and tamperproof hanging system; No.4 finish.
   3. Backing: Full-mirror sized, minimum 0.03 inch galvanized steel sheet and nonabsorptive filler material.
   4. Product: _____ manufactured by _____.

E. Seat Cover Dispenser: Stainless steel, surface-mounted, reloading by concealed opening at base, tumbler lock.
   1. Product: B-221 manufactured by Bobrick.

F. Grab Bars: Stainless steel, nonslip grasping surface finish.
   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.
      d. Products: B5806 (size as indicated) manufactured by Bobrick
         1) _____.

G. Sanitary Napkin/Tampon Dispenser: Stainless steel, surface-mounted.
   1. Product: B-2706 manufactured by Bobrick.

H. Sanitary Napkin Disposal Unit: Stainless steel, surface-mounted, self-closing door, locking bottom panel with full-length stainless steel piano-type hinge, removable receptacle.
   1. Product: B-254 manufactured by Bobrick.

I. Diaper Changing Station: Wall-mounted folding diaper changing station for use in commercial toilet facilities, meeting or exceeding ASTM F2285.
   1. Style: Horizontal.
   2. Material: Stainless steel.
   3. Mounting: Surface.
   4. Minimum Rated Load: 250 lbs.
   5. Manufacturers:
      a. Koala Kare Products; KB200-SS: www.koalabear.com.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify exact location of accessories for installation.

C. For electrically-operated accessories, verify that electrical power connections are ready and in the correct locations.

D. See Section 06 41 00 for installation of blocking, reinforcing plates, and concealed anchors in walls and ceilings.

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 the 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 the drawings.
   2. Mirrors: 39 inch, measured to bottom of mirrored surface.

3.04 PROTECTION

A. Protect installed accessories from damage due to subsequent construction operations.

END OF SECTION

SECTION 11 31 00
RESIDENTIAL APPLIANCES

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

A. Section 22 10 05 - Plumbing Piping: Plumbing connections for appliances.

B. Section 23 38 10 Commercial Kitchen Exhaust Hoods: Exhaust hood over new stove

C. Section 26 27 17 - Equipment Wiring: Electrical connections for appliances.

1.02 REFERENCE STANDARDS

A. UL (EAUED) - Electrical Appliance and Utilization Equipment Directory; Underwriters Laboratories Inc.; current edition.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data indicating dimensions, capacity, and operating features of each piece of residential equipment specified.

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

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

B. Electric Appliances: Listed and labeled by UL and complying with NEMA standards.

1.05 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide 2 year manufacturer warranty on refrigeration system of refrigerators.

C. Provide 2 year manufacturer warranty on magnetron tube of microwave ovens.

D. Provide 2 year manufacturer warranty on tub and door liner of dishwashers.

PART 2 PRODUCTS

2.01 KITCHEN APPLIANCES

A. Provide Equipment Eligible for Energy Star Rating: Energy Star Rated.

B. Refrigerator, Type Ref 1: Free-standing, side-by-side, and frost-free.
   1. Capacity: Total minimum storage of 24 cubic ft; minimum 15 percent freezer capacity.
   2. Energy Usage: Minimum 20 percent more energy efficient than energy efficiency standards set by DOE.
   3. Features: Include glass shelves, automatic icemaker, light in freezer compartment, and in-door water and ice dispenser.
   4. Exterior Finish: Stainless steel, color as indicated.
   5. Manufacturers: Any that meet the requirements of this section

C. Range, Type R-1: Electric, free-standing, with standard burners and removable drip pans.
   1. Size: 30 inches wide.
   2. Oven: Self-cleaning with electronic ignition.
   3. Elements: Four (4).
   4. Controls: Solid state electronic.
   5. Features: Include automatic meat thermometer, storage drawer, oven door window, broiler pan and grid, and oven light.
   6. Exterior Finish: Stainless steel, color as indicated.

D. Microwave, Type MW-1: Countertop.
   1. Capacity:.8 cubic ft.

2. Power: 1000 watts.
3. Features: Include turntable, cooktop light, night light, 2-speed exhaust fan, built-in trim kit, and undercabinet mounting kit.
4. Amps: 13.4
5. Dimensions 12 x 20.13 x16.56
6. Cooking Stages: 3
7. Exterior Finish: Stainless.

E. Waste Disposer, Type WD-1: Standard type, overload protection, direct wired, dishwasher connection, drain elbow, drain connector, and sound reduction features.
1. Power: 1 HP.
2. Capacity: Large.
3. Height: 14-1/2 inch.
4. Depth: 8-1/2 inch.
5. Controls: Wall switch.
6. Voltage: 115 volts, 60 Hz, 4 amps.
7. Sink Flange Kit: Stainless steel.
8. Manufacturers: Any that meet the requirements of this section

F. Dishwasher, Type DW-1: Undercounter.
1. Controls: Solid state electronic.
2. Wash Levels: Three (3).
3. Cycles: 3, including light, normal, heavy.
4. Features: Include rinse aid dispenser, optional no-heat dry, optional water temperature boost, adjustable upper rack, and adjustable lower rack.
5. Finish: Stainless steel, color as indicated.
6. Manufacturers:
   a. Hobart / Advansys; Product LXe High temperature undercounter dishwasher.
   b. Substitutions: See Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify utility rough-ins are provided and correctly located.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Anchor built-in equipment in place.

3.03 ADJUSTING

A. Adjust equipment to provide efficient operation.

3.04 CLEANING

A. Remove packing materials from equipment and properly discard.

B. Wash and clean equipment.

END OF SECTION

SECTION 11 52 13
PROJECTION SCREENS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Front projection screen assemblies.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Wood blocking in walls and ceilings.

B. Section 09 51 00 - Acoustical Ceilings: Suspended panel ceilings for recessed screens.

C. Section 26 27 17 - Equipment Wiring: Electrical supply, conduit, and wiring for electric motor operated projection screens.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's catalog cuts and descriptive information on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.
   4. Wiring diagrams for motor operators and actuators, and controls and switches.

C. Shop Drawings: For custom installations, indicate dimensions, verified field measurements, mounting details, and interface with adjacent construction.

D. Samples: For screen fabrics, submit two samples 6 x 6 inch in size.

E. Operation and Maintenance Data: Provide manufacturer's operation and maintenance instructions.

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

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Experienced in manufacturing products specified in this section.

B. Installer Qualifications: Experienced in installation of the work of this section.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver projection screens to project site in manufacturer's original unopened packaging. Inspect for damage and size before accepting delivery.

B. Store in a protected, clean, dry area with temperature maintained above 50 degrees F. Stack according to manufacturer's recommendations.

C. Acclimate screens to building temperatures for 24 hours prior to installation, or in accordance with manufacturer's recommendations.

1.06 FIELD CONDITIONS

A. Maintain interior of building between 60 degrees F and 75 degrees F during and after installation of projection screens.

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide two year manufacturer warranty for projection screen assembly.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Da-Lite Screen Company: www.da-lite.com.

B. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 FRONT PROJECTION SCREENS

A. Manufacturers:
   1. Da-Lite Screen Company; Tensioned Advantage Delux Control: www.da-lite.com.
   2. Substitutions: See Section 01 60 00 - Product Requirements.

B. Front Projection Screens: Factory assembled unless otherwise indicated.
   1. In Conference rooms 1341A and 1106: Motorized, matte light diffusing fabric screen, horizontally tensioned, wall mounted.
      a. Screen Viewing Area: 50 inch high x 80 inch wide.

C. Matte Light Diffusing Fabric: Light diffusing screen fabric; washable, flame retardant and mildew resistant.

D. Exposed Screen Cases: Steel; integral roller brackets.
   1. Finish: Baked enamel.
   2. Color: White.
   3. End Caps: Steel; finished to match case.
   4. Mounting: Wall.

E. Electrically-Operated Screens:
   1. Roller: 2 inch aluminum, with locking device.
   2. Vertical Tensioning: Screen fabric weighted at bottom with steel bar with plastic end caps.

F. Provide mounting hardware, brackets, supports, fasteners, automatic closure door and other mounting accessories required for a complete installation, in accordance with manufacturer's recommendations for specified substrates and mountings.

2.03 ELECTRICAL COMPONENTS

A. Electrical Components: Listed and classified by UL as suitable for the purpose specified and indicated.

B. Motors: Direct drive, 110 V, 60 Hz.
   1. Screen Motor: Mounted inside roller; three wire with ground; quick reverse type and lifetime lubricated; equipped with thermal overload cut-off, internal junction box, electric brake, and pre-set accessible limit switches.
      a. Electrical Characteristics: 1.2 amps.
      b. Motor mounted on sound absorber.

C. Controls: Three (3) position control switch with plate.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate is finished and ready to accept screen installation.

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

C. Verify that openings for recessed screens are correctly sized.

D. Verify that entrances to installation area are sized to permit entry of rigid screen.

E. Verify type and location of electrical connections.

F. Do not install projection screens until climate control systems are in place and interior painting and other finishes are completed.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions, using manufacturer's recommended hardware for relevant substrates.

B. Do not field cut screens.

C. Install screens in mountings as specified and as indicated on drawings.

D. Handle rigid screen materials with care to avoid damage. Use equipment only on uncoated side.

E. Install plumb and level.

F. Install electrically operated screens ready for connection to power and control systems by others.

G. Adjust projection screens and related hardware in accordance with manufacturer's instructions for proper placement and operation.

H. Test electrical screens for proper working condition. Adjust as needed.

I. Test masking systems for proper format control. Adjust as needed.

3.03 PROTECTION

A. Protect installed products until completion of project.

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

END OF SECTION

SECTION 12 21 13
HORIZONTAL LOUVER BLINDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Horizontal slat louver blinds.

B. Operating hardware.

1.02 RELATED REQUIREMENTS

A. Section 08 43 13 Aluminum Framed Storefronts: Blinds within the window system

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Horizontal Louver Blinds Without Side Guides:
   1. Hunter Douglas; CE Model: www.hunterdouglas.com.

2.02 BLINDS WITHOUT SIDE GUIDES

A. Description: Horizontal slat louvers hung from full-width headrail with full-width bottom rail.

B. Manual Operation: Control of raising and lowering by cord with full range locking; blade angle adjustable by control wand.

C. Metal Slats: Spring tempered pre-finished aluminum; square slat corners, with manufacturing burrs removed.
   1. Width: 1 inch.
   2. Thickness (Gage):.008 inch.
   3. Color: As selected by Architect.

D. Slat Support: Woven polypropylene cord, ladder configuration.

E. Head Rail: Heavy duty, pre-finished, formed aluminum box, with end caps; internally fitted with hardware, pulleys, and bearings for operation; same depth as width of slats.

F. Headrail Attachment: Wall brackets.

2.03 FABRICATION

A. Fabricate blinds to fit within openings with uniform edge clearance of 1/2 inch.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install blinds in accordance with manufacturer's instructions within gypsum board opening.

B. Secure in place with flush countersunk fasteners.

3.02 TOLERANCES

A. Maximum Variation of Gap at Window Opening Perimeter: 1/4 inch.

B. Maximum Offset From Level: 1/8 inch.

3.03 ADJUSTING

A. Adjust blinds for smooth operation.

3.04 CLEANING

A. Clean blind surfaces just prior to occupancy.

B. See Section 01 74 19 - Construction Waste Management and Disposal, for additional requirements.

3.05 SCHEDULE

A. All Section 08 43 13 Aluminum Framed Storefront windows.

END OF SECTION

SECTION 12 36 00
COUNTERTOPS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Countertops for architectural cabinet work.

B. Wall-hung counters and vanity tops.

1.02 RELATED REQUIREMENTS

A. Section 06 41 00 - Architectural Wood Casework.

B. Section 22 40 00 - Plumbing Fixtures: Sinks.

1.03 REFERENCE STANDARDS

A. ANSI Z124.3 - American National Standard for Plastic Lavatories; 2005.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2014.

C. ISFA 2-01 - Classification and Standards for Solid Surfacing Material; International Surface Fabricators Association; 2013.

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

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Specimen warranty.

C. Shop Drawings: Complete details of materials and installation; combine with shop drawings of cabinets and casework specified in other sections.

D. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and patterns.

E. Verification Samples: For each finish product specified, minimum size 6 inches square, representing actual product, color, and patterns.

F. Test Reports: Chemical resistance testing, showing compliance with specified requirements.

G. Installation Instructions: Manufacturer's installation instructions and recommendations.

1.05 QUALITY ASSURANCE

A. Fabricator Qualifications: Same fabricator as for cabinets on which tops are to be installed.

B. Installer Qualifications: Fabricator.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.07 FIELD CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 PRODUCTS

2.01 COUNTERTOP ASSEMBLIES

A. Solid Surfacing Countertops: Solid surfacing sheet or plastic resin casting over continuous substrate.

1. Flat Sheet Thickness: 1/4 inch, minimum.
2. Solid Surfacing Sheet and Plastic Resin Castings: Complying with ISFA 2-01and NEMA LD 3; acrylic or polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
    a. Surface Burning Characteristics: Flame spread 25, maximum; smoke developed 450, maximum; when tested in accordance with ASTM E84.
    b. Sinks and Bowls: Integral castings; minimum 3/4 inch wall thickness; comply with ANSI Z124.3.
    c. Finish on Exposed Surfaces: Matte, gloss rating of 5 to 20.
    d. Color and Pattern: As selected by Architect from manufacturer's full line.
    e. Manufacturers:
        1) Dupont; Corian: www.corian.com.
        2) Substitutions: See Section 01 60 00 - Product Requirements.
3. Other Components Thickness: 1/2 inch, minimum.
4. Exposed Edge Treatment: Built up to minimum 1-1/4 inch thick; radiused edge; use marine edge at sinks.
5. Back and End Splashes: Same sheet material, square top; minimum 4 inches high.
6. Skirts: As indicated on drawings.

2.02 FABRICATION

A. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
    1. Join lengths of tops using best method recommended by manufacturer.
    2. Fabricate to overhang fronts and ends of cabinets 1 inch except where top butts against cabinet or wall.
    3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.

B. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
    1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
    2. Height: 4 inches, unless otherwise indicated.

C. Solid Surfacing: Fabricate tops up to 144 inches long in one piece; join pieces with adhesive sealant in accordance with manufacturer's recommendations and instructions.

D. Wall-Mounted Counters: Provide skirts, aprons, brackets, and braces as indicated on drawings, finished to match.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

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

C. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.

B. Attach plastic laminate countertops using screws with minimum penetration into substrate board of 5/8 inch.

C. Attach wood countertops using screws with minimum penetration into substrate board of 5/8 inch.

D. Seal joint between back/end splashes and vertical surfaces.

3.04 TOLERANCES

A. Variation From Horizontal: 1/8 inch in 10 feet, maximum.

B. Offset From Wall, Countertops: 1/8 inch maximum; 1/16 inch minimum.

C. Field Joints: 1/8 inch wide, maximum.

3.05 CLEANING

A. Clean countertops surfaces thoroughly.

3.06 PROTECTION

A. Protect installed products until completion of project.

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

END OF SECTION

SECTION 22 05 01
MINOR PLUMBING DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Plumbing demolition.

B. Removal and disposal of material and equipment containing lead or lead-based paint.

1.02 RELATED REQUIREMENTS

A. Section 01 70 00 - Execution and Closeout Requirements: Additional requirements for alterations work.

B. Section 02 8401 - Mercury Remediation: Removal of equipment and materials containing substances regulated under the Oregon Reviswed Statutes, including but not limited to those containing mercury, asbestos, and lead, including lead-based paint.

C. Refer to Mechanical Demolition Plans for items to be demolished and/or replaced by a new item.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify field measurements and plumbing provisions including piping and equipment are as indicated in Drawings and Specifications.

B. Demolition drawings are based on casual field observation and existing record documents. Drawings document general scope of demolition. Verify specific dimensions and plumbing components to be demolished.

C. Report discrepancies to Architect before disturbing existing installation.

D. Beginning of demolition indicates Contractor accepts existing conditions.

3.02 PREPARATION

A. Disconnect plumbing systems in walls, floors, and ceilings to be removed. Close isolation valves and otherwise create points of connection for new systems that will minimize functional disturbance to the existing systems. Where isolation valves do not exist for individual equipment, provide pipe freezing or hot-tap installation of temporary stop valves.

B. Coordinate schedule of work with Owner to complete work during unoccupied periods where potable water service is not required or critical. Where critical service interruptions are unavoidable, provide temporary systems in service during construction. When work must be performed on energized equipment, use personnel experienced in such operations.

C. Existing Plumbing Systems: Maintain existing systems in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Minimize outage duration.
   1. Obtain permission from Owner at least 24 hours before partially or completely disabling system.
   2. Make temporary connections to maintain service in areas adjacent to work area.

3.03 DEMOLITION AND EXTENSION OF EXISTING WORK

A. Perform work for removal and disposal of equipment and materials containing toxic substances regulated under the U.S. Federal Statutes, including the Toxic Substances Control Act (TSCA) and in accordance with applicable federal, state, and local regulations. Applicable equipment and materials include, but are not limited to:
   1. Materials containing elemental lead, including but not limited to, lead drain piping and piping with lead calking.

B. Remove, relocate, and extend existing installations to accommodate new construction.

C. Remove abandoned piping and plumbing components to source of supply including piping supports, insulation, and piping accessories.

D. Disconnect and remove abandoned water heating equipment,as indicated.

E. Disconnect and remove mechanical devices and equipment serving utilization equipment that has been removed. Coordinate with demolition work in Division 2 for removal of seismic restraints and equipment supports, including roof curbs and housekeeping pads.

F. Repair adjacent construction and finishes damaged during demolition and extension work.

G. Maintain access to existing plumbing installations that remain active. Modify installation or provide access panel as appropriate.

3.04 CLEANING AND REPAIR

A. Clean and repair existing materials and equipment that remain or that are to be reused.

END OF SECTION

SECTION 22 05 19

METERS AND GAGES FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Thermometers and thermometer wells.

1.02 RELATED REQUIREMENTS

A. Section 22 10 05 Plumbing Piping

1.03 REFERENCE STANDARDS

A. ASTM E1 - Standard Specification for ASTM Liquid-in-Glass Thermometers; 2014.

B. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers; 2007.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide list that indicates use, operating range, total range and location for manufactured components.

1.05 FIELD CONDITIONS

A. Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports and test plugs.

PART 2 PRODUCTS

2.01 STEM TYPE THERMOMETERS

A. Manufacturers:
   1. Dwyer Instruments, Inc: www.dwyer-inst.com.
   2. Omega Engineering, Inc: www.omega.com.
   3. Weksler Glass Thermometer Corp: www.wekslerglass.com.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Thermometers - Fixed Mounting: Red- or blue-appearing non-toxic liquid in glass; ASTM E1; lens front tube, cast aluminum case with enamel finish.
   1. Size: 9 inch scale.
   2. Window: Clear Lexan.
   3. Accuracy: 2 percent, per ASTM E77.
   4. Calibration: Degrees F.

C. Thermometers - Adjustable Angle: Red- or blue-appearing non-toxic liquid in glass; ASTM E1; lens front tube, cast aluminum case with enamel finish, cast aluminum adjustable joint with positive locking device; adjustable 360 degrees in horizontal plane, 180 degrees in vertical plane.
   1. Size: 9 inch scale.
   2. Window: Clear Lexan.
   3. Accuracy: 2 percent, per ASTM E77.
   4. Calibration: Degrees F.

2.02 THERMOMETER SUPPORTS

A. Socket: Brass separable sockets for thermometer stems with or without extensions as required, and with cap and chain.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inch for installation of thermometer sockets. Ensure sockets allow clearance from insulation.

C. Install gages and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

D. Adjust gages and thermometers to final angle, clean windows and lenses, and calibrate to zero.

3.02 SCHEDULES

A. Stem Type Thermometers, Location and Scale Range:
   1. Headers to central equipment, 0 to 200 degrees F.
   2. Water zone supply and return, 0 to 200 degrees F.
   3. Domestic hot water supply and recirculation, 0 to 200 degrees F.

END OF SECTION

SECTION 22 05 48

VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Equipment support bases.

B. Vibration isolators.

C. Seismic restraints.

1.02 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data:

C. Shop Drawings: Indicate inertia bases and locate vibration isolators, with static and dynamic load on each. Indicate seismic control measures.

D. Manufacturer's Instructions: Indicate installation instructions with special procedures and setting dimensions.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. General:
   1. All vibration isolators, base frames and inertia bases to conform to all uniform deflection and stability requirements under all operating loads.

2.02 EQUIPMENT SUPPORT BASES

2.03 VIBRATION ISOLATORS

A. Neoprene Pad Isolators:
   1. Rubber or neoprene waffle pads.
   2. Configuration: Single layer.

B. Seismic Snubbers:
   1. Type: Non-directional and double acting unit consisting of interlocking steel members restrained by neoprene elements.
   2. Elements: Replaceable neoprene, minimum of 0.75 inch thick with minimum 1/8 inch air gap.
   3. Capacity: 4 times load assigned to mount groupings at 0.4 inch deflection.
   4. Attachment Points and Fasteners: Capable of withstanding 3 times rated load capacity of seismic snubber.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

A. Install in accordance with manufacturer's instructions.

END OF SECTION

SECTION 22 05 53

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Pipe Markers.

1.02 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; The American Society of Mechanical Engineers; 2007.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturers catalog literature for each product required.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Brady Corporation

B. Champion America, Inc

C. Seton Identification Products

2.02 NAMEPLATES

A. Description: Laminated three-layer plastic with engraved letters.
   1. Letter Color: White.
   2. Letter Height: 1/4 inch.
   3. Background Color: Black.

2.03 TAGS

A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.

B. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

C. Chart: Typewritten letter size list in anodized aluminum frame.

2.04 PIPE MARKERS

A. Comply with ASME A13.1.

B. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

C. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

PART 3 EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION

A. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain.

C. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

D. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

E. Identify air handling units, pumps, heat transfer equipment, tanks, and water treatment devices with plastic nameplates. Small devices, such as in-line pumps, may be identified with tags.

F. Identify control panels and major control components outside panels with plastic nameplates.

G. Identify thermostats relating to terminal boxes or valves with nameplates.

H. Identify valves in main and branch piping with tags.

I. Tag automatic controls, instruments, and relays. Key to control schematic.

J. Identify piping, concealed or exposed, with plastic tape pipe markers. Use tags on piping 3/4 inch diameter and smaller. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

K. Install ductwork with plastic nameplates. Identify with air handling unit identification number and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.

END OF SECTION

SECTION 22 07 19
PLUMBING PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping insulation.

B. Jackets and accessories.

1.02 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 C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded Hot Plate Apparatus; 2013.

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

F. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation; 2013.

G. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2014.

H. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2015.

I. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008 (Reapproved 2013).

J. ASTM D1056 - Standard Specification for Flexible Cellular Materials--Sponge or Expanded Rubber; 2014.

K. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2014.

L. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2014.

M. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.04 FIELD CONDITIONS

A. Maintain ambient conditions required by manufacturers of each product.

B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS

2.01 REQUIREMENTS FOR PRODUCTS OF THIS SECTION

A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER PIPING INSULATION

A. Manufacturers:

1. Johns Manville Corporation MicroLok HP
2. Owens Corning Corp SSL II
3. Knauf Earthwool
4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Insulation: ASTM C547 ; class 3, rigid molded, noncombustible.
1. 'K' value: ASTM C177, 0.24 at 75 degrees F.
2. Maximum service temperature: 850 degrees F.
3. Maximum moisture absorption: 0.2 percent by volume.

C. Vapor Barrier Jacket: White Kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches, with self-sealing longitudinal closure laps (SSL) and butt strips. Shall comply with Oregon Revised Statute 853.085 by containing less than 0.10% decabromodiphenyl ether by mass.

2.03 HYDROUS CALCIUM SILICATE

A. Manufacturers:
1. IIG Thermo-12 Gold
2. Pabco
3. Substitutions: See Section 01 60 00 - Product Requirements.

B. Insulation: ASTM C533 and ASTM C795; rigid molded, asbestos free, gold color.
1. 'K' value: ASTM C177 and C518; 0.40 at 300 degrees F, when tested in accordance with ASTM C177 or ASTM C518.
2. Maximum service temperature: 1200 degrees F.
3. Density: 15 lb/cu ft.

2.04 POLYETHYLENE

A. Manufacturers: Armacell Tubolit or approved.

B. Insulation: Flexible closed-cell polyethylene tubing, slit lengthwise for installation, complying with applicable requirements of ASTM D1056.
1. 'K' value: ASTM C177; 0.25 at 75 degrees F.
2. Maximum Service Temperature: 200 degrees F.
3. Density: 2 lb/cu ft.
4. Maximum Moisture Absorption: 1.0 percent by volume.
5. Moisture Vapor Permeability: 0.05 perm inch, when tested in accordance with ASTM E96/E96M.
6. Connection: Contact adhesive.

2.05 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturer:
1. Armacell InternationalArmaflex
2. K-Flex Insultube
3. Substitutions: See Section 01 60 00 - Product Requirements.

B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 3; use molded tubular material wherever possible.
1. Minimum Service Temperature: Minus 40 degrees F.
2. Maximum Service Temperature: 220 degrees F.
3. Connection: Waterproof vapor barrier adhesive.

2.06 JACKETS

A. PVC Plastic Valve and Fitting Covers
1. Manufacturers:
a. Johns Manville CorporationZeston 2000 Series
b. Knauf Proto
c. Speedline

d. Substitutions: See Section 01 60 00 - Product Requirements.

2. Jacket: One piece molded type fitting covers and sheet material, off-white color.
   a. Minimum Service Temperature: 0 degrees F.
   b. Maximum Service Temperature: 150 degrees F.
   c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
   d. Thickness: 10 mil.
   e. Connections: Pressure sensitive color matching vinyl tape, tacks or welding adhesive.

B. Fiberglass Valve Covers
   1. Description: Woven fiberglass jacketing around 2" thick fiberglass batt.
   2. Attachment: Stainless steel wire and lacing hooks.

2.07 JACKETS FOR EXTERIOR USE

A. Aluminum Jacket: ASTM B209 (ASTM B209M) formed aluminum sheet.
   1. Thickness: 0.016 inch sheet.
   2. Finish: Smooth.
   3. Joining: Longitudinal slip joints and 2 inch laps.
   4. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
   5. Metal Jacket Bands: 3/8 inch wide; 0.010 inch thick stainless steel.

B. Stainless Steel Jacket: ASTM A666, Type 304 stainless steel.
   1. Thickness: 0.010 inch.
   2. Finish: Smooth.
   3. Metal Jacket Bands: 3/8 inch wide; 0.010 inch thick stainless steel.

2.08 INSERTS AND SHIELDS

A. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.

B. Insert configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.

C. Insert material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Exposed Piping: Locate insulation and cover seams in least visible locations.

C. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.

D. Glass fiber insulated pipes conveying fluids below ambient temperature:
   1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive.
   2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with PVC fitting covers.

E. For hot piping conveying fluids 140 degrees F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.

F. Glass fiber insulated pipes conveying fluids above ambient temperature:
   1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive.

2. Insulate valves and fittings, including flanges, with PVC covers or fiberglass batt and woven fiberglass insulation jacketing.

G. Inserts and Shields:
1. Application: Piping 1-1/2 inches diameter or larger.
2. Insert location: Between support shield and piping and under the finish jacket.

H. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions.

I. Exterior Applications: Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

J. Heat Traced Piping: Insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size large enough to enclose pipe and heat tracer. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

3.03 SCHEDULES

A. Plumbing Systems:
1. Domestic Hot Water Supply in Recirculating Systems:
a. Glass Fiber Insulation:
1) Pipe Size Range: All sizes
2) Thickness: one inch.
2. Domestic Hot Water Supply in Non-recirculating Systems:
a. Glass Fiber Insulation:
1) Pipe Size Range: All sizes.
2) Thickness: Half inch, for first 8 feet from water heater or storage tank.
3. Domestic Hot Water Return (recirculation):
a. Glass Fiber Insulation:
1) Pipe Size Range: All sizes.
2) Thickness: One inch.
4. Domestic Cold Water, above grade:
a. Glass fiber insulation: 0.5 inch thick.
5. Solar collector supply and return:
a. Glass fiber insulation: One inch thickness.
b. Exterior piping with aluminum jacketing.

END OF SECTION

SECTION 22 30 00
PLUMBING EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Water heaters.

B. Pumps.
   1. Circulators.

1.02 RELATED REQUIREMENTS

A. Section 22 05 48 - Vibration and Seismic Controls for Plumbing Piping and Equipment.

B. Section 26 27 17 - Equipment Wiring: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1 - Rules for Construction of Pressure Vessels; The American Society of Mechanical Engineers; 2013.

B. UL 778 - Standard for Motor-Operated Water Pumps; Current Edition, Including All Revisions.

C. UL 1453 - Standard for Electric Booster and Commercial Storage Tank Water Heaters; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittals procedures.

B. Product Data:
   1. Provide dimension drawings of water heaters indicating components and connections to other equipment and piping.
   2. Indicate pump type, capacity, power requirements.
   3. Provide certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.
   4. Provide electrical characteristics and connection requirements.

C. Shop Drawings:
   1. Indicate dimensions of tanks, tank lining methods, anchors, attachments, lifting points, tappings, and drains.

D. Project Record Documents: Record actual locations of components.

E. Operation and Maintenance Data: Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.

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

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

B. Identification: Provide pumps with manufacturer's name, model number, and rating/capacity identified by permanently attached label.

1.06 CERTIFICATIONS

A. Water Heaters: NSF approved.

B. Electric Water Heaters: UL listed and labeled to UL 174 or UL 1453.

C. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.08 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer warranty for domestic water heaters.

PART 2 PRODUCTS

2.01 WATER HEATER MANUFACTURERS

A. A.O. Smith Water Products Co: www.hotwater.com.

B. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 COMMERCIAL ELECTRIC WATER HEATERS

A. Type: Factory-assembled and wired, electric, vertical storage.

B. Tank: Welded steel ASME labelled pressure vessel; glass lining, mounted on steel channel base with lifting lugs, insulated with 2 inch glass fiber; enclosed with 16 gage, 0.0598 inch steel jacket; baked enamel finish.

C. Controls: Ventilated control cabinet, factory-wired with solid state progressive sequencing step controller, fuses, magnetic contactors, control transformer, pilot lights indicating main power and heating steps, control circuit toggle switch, electronic low-water (probe-type) cut-off, high temperature limit thermostat, flush-mounted temperature and pressure gages.

D. Heating Elements: Flange-mounted immersion elements; individual elements sheathed with Incoloy corrosion-resistant metal alloy, rated less than 75 Watts per square inch.

2.03 IN-LINE CIRCULATOR PUMPS

A. Manufacturers:
   1. Refer to Schedule on Drawings.
   2. Substitutions: See Section 01 60 00 - Product Requirements.

B. Casing: Bronze, rated for 125 psig working pressure, with stainless steel rotor assembly.

C. Impeller: Bronze.

D. Shaft: Alloy steel with integral thrust collar and two oil lubricated bronze sleeve bearings.

E. Seal: Carbon rotating against a stationary ceramic seat.

F. Drive: Flexible coupling.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install plumbing equipment in accordance with manufacturer's instructions, as required by code, and complying with conditions of certification, if any.

B. Coordinate with plumbing piping and related fuel piping work to achieve operating system.

C. Pumps:
   1. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

END OF SECTION

SECTION 22 40 00
PLUMBING FIXTURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Water closets.

B. Urinals.

C. Lavatories.

D. Sinks.

E. Electric water coolers.

1.02 RELATED REQUIREMENTS

A. Section 06 41 00 - Architectural Wood Casework: Preparation of counters for sinks and lavatories.

B. Section 07 92 00 - Joint Sealants: Sealing joints between fixtures and walls and floors.

C. Section 12 36 00 - Countertops: Preparation of counters for sinks and lavatories.

D. Section 22 10 05 - Plumbing Piping.

E. Section 22 10 06 - Plumbing Piping Specialties.

F. Section 22 30 00 - Plumbing Equipment.

G. Section 26 27 17 - Equipment Wiring: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.

B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

C. ASHRAE Std 18 - Methods of Testing for Rating Drinking-Water Coolers with Self-Contained Mechanical Refrigeration; 2008.

D. ASME A112.6.1M - Supports for Off-the-Floor Plumbing Fixtures for Public Use; The American Society of Mechanical Engineers; 1997 (Reaffirmed 2002).

E. ASME A112.18.1 - Plumbing Supply Fittings; The American Society of Mechanical Engineers; 2012.

F. ASME A112.19.2 - Ceramic Plumbing Fixtures; The American Society of Mechanical Engineers; 2013.

G. ASME A112.19.3 - Stainless Steel Plumbing Fixtures (Designed for Residential Use); The American Society of Mechanical Engineers; 2008 (R2013).

H. ASME A112.19.5 - Trim for Water-Closet Bowls, Tanks and Urinals; The American Society of Mechanical Engineers; 2011.

I. ASME A112.19.14 - Six Liter Water Closets Equipped with Dual Flushing Device; 2013.

J. NSF 61 - Drinking Water System Components - Health Effects; 2012.

K. NSF 372 - Drinking Water System Components - Lead Content; 2011.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.

C. Samples: Submit two lavatory supply fittings.

D. Manufacturer's Instructions: Indicate installation methods and procedures.

E. Maintenance Data: Include fixture trim exploded view and replacement parts lists.

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

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Faucet Washers: One set of each type and size.
   3. Extra Lavatory Supply Fittings: One set of each type and size.
   4. Extra Toilet Seats: One of each type and size.
   5. Flush Valve Service Kits: One for each type and size.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.06 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Accept fixtures on site in factory packaging. Inspect for damage.

B. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

1.08 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer warranty for electric water cooler.

PART 2 PRODUCTS

2.01 GENERAL

A. Potable Water Systems: Provide plumbing fittings and faucets that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

2.02 FLUSH VALVE WATER CLOSETS

A. Water Closets (WC1): Existing bowl, salvaged for re-installation, vitreous china, floor mounted, siphon jet flush action, china bolt caps.

B. Water Closets (WC2): Vitreous china, ASME A112.19.2, floor mounted, siphon jet flush action, china bolt caps.
   1. Bowl: ASME A112.19.2; 16.5 inches high with elongated rim.
   2. Flush Valve: Exposed (top spud).
   3. Flush Operation: Manual, Dual Flush.
   4. Handle Height: 44 inches or less.
   5. Supply Size: 1-1/2 inches.
   6. Color: White.
   7. Manufacturers:
      a. American Standard, Inc; MADERA ADA Toilet: www.americanstandard-us.com.
      b. Substitutions: See Section 01 60 00 - Product Requirements.

C. Flush Valves: ASME A112.18.1, diaphragm type, complete with vacuum breaker stops and accessories.
   1. Exposed Type: Chrome plated, escutcheon, integral screwdriver stop.
   2. Dual Flush Type: Dual action, lifting handle up initiates reduced flush (1.1 gpf); pushing handle down initiates full flush (1.6 gpf). Antimicrobial handle coating. Adhesive-backed metal wall sign with flushing instructions.
   3. Manufacturers:
      a. Sloan Valve Company; Uppercut Manual Dual Flush Flushometer: www.sloanvalve.com.
      b. Substitutions: See Section 01 60 00 - Product Requirements.

D. Seats:
   1. Manufacturers:
      a. American Standard, Inc: www.americanstandard-us.com.
      b. Bemis Manufacturing Company: www.bemismfg.com.
      c. Church Seat Company: www.churchseats.com.
      d. Olsonite: www.olsonite.com.
      e. Substitutions: See Section 01 60 00 - Product Requirements.
   2. Solid white plastic, open front, extended back, self-sustaining hinge, brass bolts, with cover.

2.03 WALL HUNG URINALS (U-1)

A. Wall Hung Urinal Manufacturers:
   1. American Standard, Inc; WASHBROOK Urinal: www.americanstandard-us.com.
   2. Substitutions: See Section 01 60 00 - Product Requirements.

B. Urinals: Vitreous china, ASME A112.19.2, wall hung with side shields and concealed carrier.
   1. Flush Volume: 1.0 gallon, maximum.
   2. Flush Style: Washout.
   3. Flush Valve: Exposed (top spud).
   4. Flush Operation: Sensor operated.
   5. Trap: Integral.
   6. Removable stainless steel strainer.
   7. Supply Size: 3/4 inch.

C. Flush Valves: ASME A112.18.1, diaphragm type, complete with vacuum breaker stops and accessories.
   1. Exposed Type: Chrome plated, escutcheon, integral screwdriver stop.
   2. Manufacturers:
      a. Sloan Valve Company; Model Royal 186: www.sloanvalve.com.
      b. Substitutions: See Section 01 60 00 - Product Requirements.

D. Carriers:
   1. Manufacturers:
      a. JOSAM Company: www.josam.com.
      b. Zurn Industries, Inc: www.zurn.com.
      c. Substitutions: See Section 01 60 00 - Product Requirements.
   2. ASME A112.6.1M; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, threaded fixture studs for fixture hanger, bearing studs.

2.04 STALL URINALS (U-2)

A. Stall Urinal Manufacturers:
   1. American Standard, Inc; Model Stallbrook: www.americanstandard-us.com.
   2. Substitutions: See Section 01 60 00 - Product Requirements.

B. Urinal: ASME A112.19.2; vitreous china slope front stall urinal with integral flushing rim, removable stainless steel strainer 3/4 inch top spud.

C. Flush Valve Manufacturers:
   1. Sloan Valve Company; Model Royal 186: www.sloanvalve.com.
   2. Substitutions: See Section 01 60 00 - Product Requirements.

D. Exposed Flush Valve: ASME A112.18.1; exposed chrome plated, diaphragm type with oscillating handle, escutcheon, integral screwdriver stop, vacuum breaker; maximum 1.0 gallon flush volume.

2.05 LAVATORIES

A. Lavatory Manufacturers:
   1. American Standard, Inc: www.americanstandard-us.com.
   2. Gerber Plumbing Fixtures LLC; Model _____: www.gerberonline.com.

3. Kohler Company; Model _____: www.kohler.com.
4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Vitreous China Wall Hung Basin (L2): ASME A112.19.2; vitreous china wall hung lavatory, 20 by 19 inch minimum, with 4 inch high back, rectangular basin with splash lip, front overflow, and soap depression.

C. Vitreous China Couter Top Basin (L1): ASME A112.19.2 vitreous china self-rimming counter top lavatory, rectangular Studio Style, with center hole only for sensor-activated faucet. Front overflow.

D. Sensor Operated Faucet: Cast brass, chrome plated, deck mounted with sensor located on neck of spout.
1. Spout Style: Standard.
2. Power Supply: 24 VAC.
   a. Cord and plug.
   b. For 24V applications, provide transformer.
   c. Battery backup, alkaline or lithium, minimum 200,000 cycles. Low battery indicator warning light at 30 days remaining life with continuous light at 2 weeks remaining life.
3. Mixing Valve: External lever operated.
4. Water Supply: 3/8 inch compression connections.
5. Aerator: Vandal resistant, 0.5 GPM, laminar flow device.
6. Automatic Shut-off: 30 seconds, adjustable.
7. Sensor range: Factory set at a minimum of 3 inch adjustable up to 24 inch.
8. Sensor range: Automatically adjusts.
9. Finish: Polished chrome.
10. Sensor Operated Faucet Manufacturers:
    a. Sloan Valve Company; Model EAF-150: www.sloanvalve.com.
    b. Substitutions: See Section 01 60 00 - Product Requirements.

E. Accessories:
1. Chrome plated 17 gage, 0.0538 inch brass P-trap with clean-out plug and arm with escutcheon.
2. Offset waste with perforated open strainer.
3. Trap and Supply Insulation Kits
   a. Complies with ADA requirements for insulating pipes and fittings under handicapped accessible fixtures.
   b. Material: Molded closed cell vinyl.
   c. Components: Pre-molded to fit trap, tail piece, wall bend, supplies, and stops.
   d. Burning Characteristics: Self-extinguishing when tested in accordance with ASTM D635.
   e. Color: White.
   f. Manufacturer: McGuire, Truebro, EBC, or approved. Similar to McGuire "ProWrap".
4. Quarter-turn stops, threaded (IPS) inlet, BrassCraft Model G2 or approved. Compression/ferrule stops not acceptable.
5. Rigid brass supplies, chrome-plated. BrassCraft or similar.

2.06 SINKS

A. Sink Manufacturers:
1. Elkay.
2. Just.
3. Substitutions: See Section 01 60 00 - Product Requirements.

B. Single Compartment Bowl (S3): ASME A112.19.3; 16 by 13.5 by 6 inch outside dimensions 20 gage, 0.0359 inch thick, Type 302 stainless steel, self rimming and undercoated, with ledge back drilled for trim.
1. Drain: 1-1/2 inch chromed brass drain with P-trap.
2. Outlet: 3-1/2 inch crumb cup and tailpiece.

3. Faucet: Single lever side valve, two hole mount, 10 inch gooseneck spout, 2.0 gpm aerator, adjustable limit stop, chrome finish. Chicago, Zurn, Delta, or approved. Similar to Chicago Model 2302.

C. Double Compartment Bowl (S1): ASME A112.19.3; 33 by 22 by 9 inch outside dimensions 20 gage, 0.0359 inch thick, Type 302 stainless steel, self rimming and undercoated, with ledge back drilled for trim.
   1. Drain: 1-1/2 inch chromed brass drain with P-Trap and tee connection.
   2. Outlet: 3-1/2 inch crumb cups and tailpieces.
   3. Faucet: Single lever, 8 inch cover plate, 10 inch spout, 2.0 gpm aerator, adjustable limit stop, chrome plate finish. Chicago, Zurn, Delta, or approved. Similar to Chicago Model 2300-8.

D. Double Compartment Bowl (S2): ASME A112.19.3; 33 by 22 by 6 inch outside dimensions 20 gage, 0.0359 inch thick, Type 302 stainless steel, self rimming and undercoated, with ledge back drilled for trim.
   1. Drain: 1-1/2 inch chromed brass drain.
   2. Outlet: 3-1/2 inch crumb cup and tailpiece.
   3. Faucet: Single lever, 8 inch cover plate, 10 inch spout, 2.0 gpm aerator, adjustable limit stop, chrome plate finish. Chicago, Zurn, Delta, or approved. Similar to Chicago Model 2300-8.

E. Janitor's Mop Sink (S4):
   1. Mop service basin, one-piece, floor-mounted.
   2. Overall dimensions 36 inches x 24 inches x 10 inches high.
   3. Molded stone, white.
   4. Manufacturer: Fiat, Crane, Mustee, Florestone, or approved. Similar to Fiat Model MSB-3624.
   5. Faucet: Wall-mounted service type, 6 inch spout with integral vacuum breaker, 3/4 inch threaded hose outlet, adjustable centers, integral check arms, chrome plated. Chicago, Zurn or approved. Similar to Chicago Model 886-HC.
   6. Supplies: 1/2 inch ball valve in HW and CW supplies for isolation. See Part 3, Execution.
   7. Drain: Factory installed type 302 stainless steel body with combi-nation dome strainer and lint basket. See Drawings for outlet size.
   8. Accessories: Mop hanger with three clamps, 30 inch hose with 3/4 inch brass coupling and stainless steel hose bracket, vinyl bumper guards. Similar to Fiat Models 889-CC, 832-AA, and E-77-AA.

2.07 ELECTRIC WATER COOLERS

A. Electric Water Cooler Manufacturers:
   1. Elkay Manufacturing Company; _____: www.elkay.com.
   2. Substitutions: See Section 01 60 00 - Product Requirements.

B. Water Cooler: Electric, mechanically refrigerated; surface handicapped mounted; stainless steel top, vinyl on steel body, elevated anti-squirt bubbler with stream guard, automatic stream regulator, push button, mounting bracket; integral air cooled condenser and stainless steel grille.
   1. Capacity: 8 gallons per minute of 50 degrees F water with inlet at 80 degrees F and room temperature of 90 degrees F, when tested in accordance with ASHRAE Std 18.
   2. Electrical: 115 V, 60 Hertz compressor, 6 foot cord and plug for connection to electric wiring system including grounding connector.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.

B. Verify that electric power is available and of the correct characteristics.

C. Confirm that millwork is constructed with adequate provision for the installation of counter top lavatories and sinks.

3.02 PREPARATION

A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.03 INSTALLATION

A. Install each fixture with trap, easily removable for servicing and cleaning.

B. Provide chrome plated rigid supplies to fixtures with loose key stops, reducers, and escutcheons.

C. Install components level and plumb.

D. Install and secure fixtures in place with wall supports and bolts.

E. Solidly attach water closets to floor with lag screws. Lead flashing is not intended hold fixture in place.

F. Provide continuous seal of plumber's putty between counter-mounted lavatories and counter. Seal around fixtures with flexible white silicone caulk at interface between fixture and wall or counter surface.

G. Provide supply and stop cover on hot water at exposed installations.

H. Provide accessories as specified for new water closets where salvaged water closet fixtures are to be re-installed.

I. Install signs on walls where provided with dual-flush flushometers.

3.04 INTERFACE WITH WORK OF OTHER SECTIONS

A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

3.05 ADJUSTING

A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.06 CLEANING

A. Clean plumbing fixtures and equipment.

3.07 PROTECTION

A. Protect installed products from damage due to subsequent construction operations.

B. Do not permit use of fixtures by construction personnel.

C. Repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 23 01 30.51
HVAC AIR DUCT CLEANING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cleaning of HVAC duct system, equipment, and related components.

1.02 RELATED REQUIREMENTS

A. Section 01 40 00 - Quality Requirements : Additional requirements for testing and inspection agencies.

B. Section 01 91 13 - General Commissioning Requirements: Commissioning requirements that apply to all types of work.

C. Section 23 08 00 - Commissioning of HVAC.

1.03 DEFINITIONS

A. HVAC System: For purposes of this section, the surfaces to be cleaned include all interior surfaces of the existing heating, air-conditioning and ventilation system to remain from the points where the air enters the system to the points where the air is discharged from the system, including the inside of air distribution equipment, coils, and condensate drain pans.
   1. Air handling unit cabinet and components are required to be cleaned.
   2. Welded steel supply air ductwork is required to be cleaned.
   3. Above-ceiling plenum for return air is required to be cleaned.

1.04 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2014.

B. NADCA ACR - Assessment, Cleaning and Restoration of HVAC Systems; 2014.

C. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; Current Edition, Including All Revisions.

D. UL 181A - Standard for Closure Systems for Use with Rigid Air Ducts; Current Edition, Including All Revisions.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Material Safety Data Sheets (MSDS): For all chemical products proposed to be used in the cleaning process; submit directly to Owner.

C. Project Closeout Report: Include field quality control reports, evidence of satisfactory cleaning, and documentation of items needing further repair.

1.06 QUALITY ASSURANCE

A. Information Available to Contractor: Demolition drawings showing components to remain.

B. Cleaning Contractor Qualifications: Company specializing in the cleaning and restoration of HVAC systems as specified in this section.
   1. Having minimum of three years documented experience.

PART 2 PRODUCTS

2.01 TOOLS AND EQUIPMENT

A. Vacuum Devices and Other Tools: Exceptionally clean, in good working order, and sealed when brought into the facility.

B. Vacuum Devices That Exhaust Air Inside Building, Including Hand-Held and Wet Vacuums: Equipped with HEPA filtration with 99.97 percent collection efficiency for minimum 0.3-micron size particles and DOP test number.

C. Vacuum Devices That Exhaust Air Outside Building, Including Truck- and Trailer-Mounted Types: Equipped with particulate collection including adequate filtration to contain debris removed from the HVAC system; exhausted in manner that prevents contaminant re-entry to building; compliant with applicable regulations as to outdoor environmental contamination.

PART 3 EXECUTION

3.01 PROJECT CONDITIONS

A. Comply with applicable federal, state, and local requirements.

B. Perform cleaning, inspection, and remediation in accordance with the recommendations of NADCA "Assessment, Cleaning and Restoration of HVAC Systems" (ACR) and as specified herein.

C. Where NADCA ACR uses the terms "recommended", "highly recommended", or "ideally" in regard to a certain procedure or activity, do that unless it is clearly inapplicable to the project.

D. Obtain Owner's approval of proposed temporary locations for large equipment.

E. Designate a decontamination area and obtain Owner's approval.

F. If unforeseen mold or other biological contamination is encountered, notify Architect immediately, identifying areas affected and extent and type of contamination.

3.02 EXAMINATION

A. Inspect the system components to be cleaned following demolition to determine appropriate methods, tools, equipment, and protection.

B. Start of cleaning work constitutes acceptance of existing conditions.

C. When concealed spaces are later made accessible, examine and document interior conditions prior to beginning cleaning.

D. Document all instances of mold growth, rodent droppings, other biological hazards, and damaged system components.

3.03 PREPARATION

A. When cleaning work might adversely affect life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with authorities having jurisdiction.

B. Ensure that electrical components that might be adversely affected by cleaning are de-energized, locked out, and protected prior to beginning work.

C. Air-Volume Control Devices: Mark the original position of dampers and other air-directional mechanical devices inside the HVAC system prior to starting cleaning.

D. Access to Concealed Spaces: Use existing service openings and make additional service openings as required to accomplish cleaning and inspection.
   1. Do not cut openings in non-HVAC components without obtaining the prior approval of Owner.
   2. Make new openings in HVAC components in accordance with NADCA Standard 05; do not compromise the structural integrity of the system.
   3. Do not cut service openings into flexible duct; disconnect at ends for cleaning and inspection.

E. Ceiling Tile: In general, ceaning should occur once the existing ceiling is removed. If minor cleaning occurs following installation of new celing, lay-in ceiling tile may be removed to gain access to HVAC systems during the cleaning process. Protect tile from damage and reinstall upon completion. Replace damaged tile.

3.04 CLEANING

A. Use any cleaning method recommended by NADCA ACR unless otherwise specified; do not use methods prohibited by NADCA ACR, or that will damage HVAC components or other work, or that will significantly alter the integrity of the system.

B. Obtain Owner's approval before using wet cleaning methods; ensure that drainage is adequate before beginning.

C. Ducts: Mechanically clean all portions of ducts.

D. Hoses, Cables, and Extension Rods: Clean using suitable sanitary damp wipes at the time they are being removed or withdrawn from their normal position.

E. Registers, Diffusers, and Grilles: When removing, take care to prevent containment exposure due to accumulated debris.

F. Coils: Follow NADCA ACR completely including measuring static pressure drop before and after cleaning; do not remove refrigeration coils from system to clean; report coils that are permanently impacted.

G. Collect debris removed during cleaning; ensure that debris is not dispersed outside the HVAC system during the cleaning process.

H. Store contaminated tools and equipment in polyethylene bags until cleaned in the designated decontamination area.

3.05 REPAIR

A. Repair openings cut in the ventilation system so that they do not significantly alter the airflow or adversely impact the facility's indoor air quality.

B. At insulated ducts and components, accomplish repairs in such a manner as to achieve the equivalent thermal value.

C. Reseal new openings in accordance with NADCA Standard 05.

D. Reseal rigid fiber glass duct systems using closure techniques that comply with UL 181 or UL 181A.

E. When new openings are intended to be capable of being re-opened in the future, clearly mark them and report their locations to Owner in project report documents.

3.06 FIELD QUALITY CONTROL

A. Ensure that the following field quality control activities are completed prior to application of any treatments or coatings and prior to returning HVAC system to normal operation.

B. Visually inspect all portions of the cleaned components; if not visibly clean as defined in NADCA ACR, re-clean and reinspect.

C. Coils: Cleaning must restore the coil pressure drop to within 10 percent of the coil's original installed pressure drop; if original pressure drop is not known, coil will be considered clean if free of foreign matter and chemical residue based on visual inspection.

D. Notify Architect when cleaned components are ready for inspection.

E. When directed, re-clean components until they pass.

F. Submit evidence that all portions of the system required to be cleaned have been cleaned satisfactorily.

3.07 ADJUSTING

A. After satisfactory completion of field quality control activities, restore adjustable devices to original settings, including, but not limited to, dampers, air directional devices, valves, fuses, and circuit breakers.

3.08 WASTE MANAGEMENT

A. Double-bag all waste and debris in 0.24 inch polyethylene bags.

B. Dispose of debris off-site in accordance with applicable federal, state and local requirements.

END OF SECTION

SECTION 23 05 01

MINOR MECHANICAL DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Mechanical demolition.

B. Removal and disposal of material and equipment containing lead and lead-based paint.

1.02 RELATED REQUIREMENTS

A. Section 01 70 00 - Execution and Closeout Requirements: Additional requirements for alterations work.

B. Section 23 01 30 - HVAC Air Duct Cleaning.

C. Drawings: Demolition plans, partial plans, and schematic diagrams: M111, M113, M121, M131, M141, M211, M221, M231, M311, M601.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Materials and equipment for patching and extending work: As specified in individual sections.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify field measurements and mechanical provisions (includes ductwork, piping, and equipment) are as indicated in Drawings and Specifications.

B. Verify mechanical provisions which have been previously abandoned in place.

C. Demolition drawings are based on casual field observation and existing record documents. Verify mechanical provisions to be demolished.

D. Report discrepancies to Architect before disturbing existing installation.

E. Design phase review of existing conditions indicates that no asbestos containing materials are present in the mechanical equipment and components to be removed. Report any observed presence of asbestos to Architect and Owner before disturbing materials. If required, Owner will independently procure asbestos remediation services that are not in this contract.

F. Beginning of demolition indicates Contractor accepts existing conditions.

3.02 PREPARATION

A. Disconnect mechanical systems in walls, floors, and ceilings to be removed.

3.03 DEMOLITION AND EXTENSION OF EXISTING MECHANICAL WORK

A. Perform work for removal and disposal of equipment and materials containing toxic substances regulated under the U.S. Federal Statutes, including the Toxic Substances Control Act (TSCA) and Oregon Revised Statutes in accordance with applicable federal, state, and local regulations. Applicable equipment and materials include, but are not limited to:
   1. Mercury-containing temperature sensors and position sensors.
   2. Materials and equipment containing lead-based paints.
   3. Materials containing elemental lead, including but not limited to, lead drain piping and piping with lead calking.

B. Remove, relocate, and extend existing installations to accommodate new construction.

C. Remove abandoned piping to source of supply including piping supports, insulation, and piping accessories.

D. Remove exposed abandoned conduit, ducts, and piping, including those located above accessible ceiling finishes.

E. Disconnect and remove abandoned mechanical equipment.

F. Disconnect and remove mechanical devices and equipment serving utilization equipment that has been removed. Coordinate with demolition work in Division 2 for removal of seismic restraints and equipment supports, including roof curbs and housekeeping pads.

G. Repair adjacent construction and finishes damaged during demolition and extension work.

H. Maintain access to existing mechanical installations that remain active. Modify installation or provide access panel as appropriate.

I. Extend existing installations using materials and methods as specified and indicated.

3.04 CLEANING AND REPAIR

A. Clean and repair existing materials and equipment that remain or that are to be reused.

B. Clean surfaces and floors where mechnical equipment is removed. Cut all inserts, anchors, bolts, pipes, and other unused equipment supports flush with structural surface such that surfaces to remain are smooth and safe. Remove burrs and smooth sharp edges.

END OF SECTION

SECTION 23 05 13

COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Single phase electric motors.

B. Three phase electric motors.

C. Three phase electric motors supplied with mechanical equipment.

1.02 RELATED REQUIREMENTS

A. Section 26 27 17 - Equipment Wiring: Electrical characteristics and wiring connections.

B. Section 26 29 13 - Enclosed Controllers.

1.03 REFERENCE STANDARDS

A. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings; American Bearing Manufacturers Association, Inc.; 2015.

B. IEEE 112 - IEEE Standard Test Procedure for Polyphase Induction Motors and Generators; Institute of Electrical and Electronic Engineers; 2004.

C. NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association; 2014.

D. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide wiring diagrams with electrical characteristics and connection requirements.

C. Test Reports: Indicate test results verifying nominal efficiency and power factor for three phase motors larger than 1/2 horsepower.

D. Manufacturer's Installation Instructions: Indicate setting, mechanical connections, lubrication, and wiring instructions.

E. Operation Data: Include instructions for safe operating procedures.

F. Maintenance Data: Include assembly drawings, bearing data including replacement sizes, and lubrication instructions.

1.05 QUALITY ASSURANCE

A. Conform to NFPA 70.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weather-proof covering. For extended outdoor storage, remove motors from equipment and store separately.

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 GENERAL CONSTRUCTION AND REQUIREMENTS

A. Electrical Service: Refer to Mechanical Schedules in Drawings for required electrical charateristics.

B. Construction:

1. Open drip-proof type except where specifically noted otherwise.
2. Design for continuous operation in 40 degrees C environment.
3. Design for temperature rise in accordance with NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.
4. Motors with frame sizes 145T and larger: Premium Efficiency Type.

C. Visible Nameplate: Indicating motor horsepower, voltage, phase, cycles, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor, efficiency.

D. Wiring Terminations:
1. Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70, threaded for conduit.
2. For fractional horsepower motors where connection is made directly, provide threaded conduit connection in end frame.

2.02 APPLICATIONS

A. Motors mounted in new equipment: To be provided by equipment manufacturer with required mounting hardware.

2.03 SINGLE PHASE POWER - SPLIT PHASE MOTORS

A. Starting Torque: Less than 150 percent of full load torque.

B. Starting Current: Up to seven times full load current.

C. Breakdown Torque: Approximately 200 percent of full load torque.

D. Drip-proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA Service Factor, prelubricated sleeve or ball bearings.

E. Enclosed Motors: Class A (50 degrees C temperature rise) insulation, 1.0 Service Factor, prelubricated ball bearings.

2.04 SINGLE PHASE POWER - PERMANENT-SPLIT CAPACITOR MOTORS

A. Starting Torque: Exceeding one fourth of full load torque.

B. Starting Current: Up to six times full load current.

C. Multiple Speed: Through tapped windings.

D. Open Drip-proof or Enclosed Air Over Enclosure: Class A (50 degrees C temperature rise) insulation, minimum 1.0 Service Factor, prelubricated sleeve or ball bearings, automatic reset overload protector.

2.05 THREE PHASE POWER - SQUIRREL CAGE MOTORS

A. Starting Torque: Between 1 and 1-1/2 times full load torque.

B. Starting Current: Six times full load current.

C. Power Output, Locked Rotor Torque, Breakdown or Pull Out Torque: NEMA Design B characteristics.

D. Design, Construction, Testing, and Performance: Conform to NEMA MG 1 for Design B motors.

E. Insulation System: NEMA Class B or better.

F. Testing Procedure: In accordance with IEEE 112. Load test motors to determine free from electrical or mechanical defects in compliance with performance data.

G. Motor Frames: NEMA Standard T-Frames of steel, aluminum, or cast iron with end brackets of cast iron or aluminum with steel inserts.

H. Thermistor System (Motor Frame Sizes 254T and Larger): Three PTC thermistors embedded in motor windings and epoxy encapsulated solid state control relay for wiring into motor starter; refer to Section 26 29 13.

I. Bearings: Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum ABMA STD 9, L-10 life of 20,000 hours. Calculate bearing load with NEMA minimum V-belt pulley with belt center line at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.

J. Sound Power Levels: To NEMA MG 1.

K. Nominal Efficiency: As scheduled at full load and rated voltage when tested in accordance with IEEE 112.

L. Nominal Power Factor: As scheduled at full load and rated voltage when tested in accordance with IEEE 112.

M. Inverter Ready: Motors 1-1/2 hp and larger shall be inverter ready, unless controlled by VFD.

N. Inverty Duty: For all motors to be controlled by VFD.

O. Shaft grounding: Provide bearing protection ring, Aegis or approved, for all motors to be controlled by VFD.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install securely on firm foundation. Mount ball bearing motors with shaft in any position.

C. Check line voltage and phase and ensure agreement with nameplate.

3.02 SCHEDULE

A. 460V, 3-Phase - Energy Efficient, Open Drip-Proof Performance:
   1. 1800 rpm.
      a. 5 hp:
         1) NEMA Frame: 184T.
         2) Minimum Percent Power Factor: 80.7
         3) Minimum Percent Efficiency: 89.5
      b. 40 hp:
         1) NEMA Frame: 324T.
         2) Minimum Percent Power Factor: 82.
         3) Minimum Percent Efficiency: 94.

END OF SECTION

SECTION 23 05 15
VARIABLE FREQUENCY DRIVES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Variable frequency drives for fans.

B. Startup and programming of drives.

1.02 RELATED SECTIONS

A. Section 26 2923 - Variable Frequency Drives (Installation)

1.03 SHOP DRAWINGS AND PRODUCT DATA

A. Submit shop drawings and product data under provisions of Section 01 3000.

B. Include product data:
   1. Provide product data for adjustable frequency drive.
   2. Provide product data for motor starters and combination motor starters, relays, pilot devices, and switching and overcurrent protective devices.
   3. Submit manufacturers' instructions under provisions of Section 01 3000.

C. Indicate on shop drawings:
   1. Front and side views of motor control center enclosures with overall dimensions.
   2. Conduit entrance locations and requirements.
   3. Nameplate legends.
   4. Electrical operating and control characteristics of all equipment and components.

1.04 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data under provisions of Section 01 3000. Include the following:
   1. Spare parts data listing.
   2. Source and current prices of replacement parts and supplies.
   3. Recommended maintenance procedures and intervals.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Delivery:
   1. Deliver products to site under provisions of Section 01 6000.

B. Storage:
   1. Store and protect products under provisions of Section 01 6000.
   2. Store in a clean, dry space.
   3. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handling:
   1. Handle in accordance with manufacturer's written instructions.
   2. Handle carefully to avoid damage to motor control center components, enclosure, and finish.

PART 2 PRODUCTS

2.01 VARIABLE FREQUENCY DRIVE (VFD)

A. Acceptable manufacturers:
   1. ABB
   2. Square D
   3. Allen Bradley
   4. Toshiba
   5. Cutler Hammer
   6. Substitutions: Under provisions of Section 01600.

B. Drives and motors shall be furnished by same vendor, to ensure single-source responsibility.

C. Voltage Rating: As required for motor, three phase, three wire, 60 hertz.

D. VFD shall be furnished with door mounted operator controls consisting of Hand/Off/ auto switch, start/stop (reset switch, speed selection and 40 character LCD alphanumeric display. In automatic mode, VFD will follow an external signal and respond to remote start-stop contact wired to terminal strip. While in auto mode the VFD will attempt up to ten restarts after a power dip, drive fault or external fault.

E. 40 character LCD alphanumeric display.
   1. Frequency.
   2. Speed (RPM, %, or user programmable).
   3. Motor current.
   4. Torque (calculated).
   5. Motor power (calculated).
   6. DC buss voltage.
   7. Output voltage.
   8. Heatsink temperature.
   9. Elapsed time meter.
   10. kWh meter.
   11. Fault Text.

F. Controllers: Provide controllers for motorized equipment as indicated on the Equipment Connection Schedule.

G. Two stage current limit:
   1. 175% at start-up.
   2. 50% to 150% motor load current.

H. Power factor: 95% minimum.

I. Fault withstand capability: 18,000 symmetrical amperes.

J. Instantaneous overcurrent trip: Non-adjustable, 180% of controller continuous rated current.

K. Enclosure: Wall mounted NEMA 1.

L. The adjustable frequency controller shall convert three-phase 60 Hertz utility power to adjustable voltage and frequency, three-phase, A-C power for stepless motor control from 10% to 110% of base speed.

M. The VFD shall be a voltage source type with a Pulse Width Modulated (PWM) output utilizing power transistor semiconductors.

N. The VFD together with all options and modifications shall mount within standard NEMA 1 enclosure suitable for continuous operation at a maximum ambient temperature of 40 degree C. All high voltage components within enclosure shall be isolated with steel covers. The complete unit shall be UL approved and labeled.

O. VFD shall be capable of starting into a rotating load without delay. Protective circuits shall cause instantaneous trip should any of the following faults occur:
   1. 115% of VFD maximum current rating is exceeded.
   2. Output phase to phase or phase to ground (ground fault) short circuit condition.
   3. High input line voltage.
   4. Loss of input phase.
   5. External fault. This protective circuit shall permit, by means of the terminal strip, wiring of remote NC safety contacts such as high static, pressure, fire alarm duct detector, etc., to shut down the drive.

P. The following adjustments shall be available in the controller and retained in non-volatile memory:
   1. Maximum frequency (15 to 400 Hz) factory set at 60 Hz.
   2. Minimum frequency (3 to 60 Hz) factory set at 6 Hz.
   3. Acceleration (.1 to 360 second) factory set at 20 sec.

4. Deceleration (.1 to 360 seconds) factory set at 20 sec.
5. Volts/Hertz ratio factory set for 200 V at 60 Hz.
6. Voltage offset or boost factory set at 100% torque.
7. Current limit (50% to 115% sine wave current rating) factory set at 11% current.

Q. The VFD shall be capable of following:
1. 0(4)-20 MA.
2. 0(2)-10 VDC.
3. RS-485 communications.
4. Frequency pulse isolated or non-isolated signals as speed reference (increase/decrease speed control.

R. The VFD shall have a programmable electronic overload designed to protect the A-C motor, operated on VFD output, from extended overload operation.

S. The VFD shall provide true ground fault protection in all modes, starting and running, without any component failure, A D-C bus contactor shall be used to provide this protection.

T. The VFD shall have three critical frequency avoidance bands to skip frequencies, which may cause mechanical damage.

U. The VFD shall have a digital display with the following display:
1. Instantaneous output current, voltage, and frequency.
2. First fault indication of over temperature, motor overload, high D-C bus voltage, high motor current line to line and line to ground, function loss, low D-C bus voltage.

V. The VFD shall have an internal input line reactor and/or isolation transformer to minimize nuisance trips, line noise, and electrical line problems. VFD operation shall result in less than l0% total harmonic distortion on the electrical distribution system.

W. The VFD shall be compatible with squirrel cage fan motors.

PART 3 EXECUTION

3.01 INSTALLATION

A. Installation shall be by Division 26. See Section 26 2923.

3.02 VARIABLE FREQUENCY DRIVE START UP AND PROGRAMMING SERVICE

A. Start-up service including physical inspection of drive and connected wiring, programming, and final adjustments to meet specified performance requirements shall be provided by a factory trained service engineer employed by the manufacturer.

END OF SECTION

SECTION 23 05 19
METERS & GAGES FOR HVAC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pressure gages and pressure gage taps.

B. Thermometers and thermometer wells.

1.02 RELATED REQUIREMENTS

A. Section 23 21 13 - Hydronic Piping.

B. Section 23 09 23 - Direct-Digital Control System for HVAC.

C. Section 23 09 93 - Sequence of Operations for HVAC Controls.

1.03 REFERENCE STANDARDS

A. ASME B40.100 - Pressure Gauges and Gauge Attachments; The American Society of Mechanical Engineers; 2013.

B. ASTM E1 - Standard Specification for ASTM Liquid-in-Glass Thermometers; 2014.

C. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers; 2007.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide list that indicates use, operating range, total range and location for manufactured components.

C. Project Record Documents: Record actual locations of components and instrumentation.

D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.

1.05 FIELD CONDITIONS

A. Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports and test plugs.

PART 2 PRODUCTS

2.01 PRESSURE GAGES

A. Manufacturers: Ashcroft Type 3005 or 3006p, Trerice, Weiss, Weksler, or approved.

B. Pressure Gages: ASME B40.100, UL 393 drawn steel case, phosphor bronze bourdon tube, rotary brass movement, brass socket, with front recalibration adjustment, black scale on white background.
   1. Case: ABS or Steel with brass bourdon tube.
   2. Size: 2-1/2 inch diameter.
   3. Mid-Scale Accuracy: Grade B 3-2-3 percent.
   4. Scale: Psi.

2.02 PRESSURE GAGE TAPPINGS

A. Gage Cock: Tee or lever handle, brass for maximum 150 psi.

2.03 STEM TYPE THERMOMETERS

A. Manufacturers: Ashcroft, Trerice, Weiss, Weksler, or approved.

B. Thermometers - Fixed Mounting: Red- or blue-appearing non-toxic liquid in glass; ASTM E1; lens front tube, cast aluminum case with enamel finish.
   1. Size: 9 inch scale.
   2. Window: Clear Lexan.
   3. Accuracy: 2 percent, per ASTM E77.
   4. Calibration: Degrees F.

2.04 THERMOMETER SUPPORTS AND THERMOWELLS

A. Socket: Brass separable sockets for thermometer stems and DDC furnished temperature sensors with or without extensions as required, and with cap and chain.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide two pressure gages per pump, installing taps before strainers and on suction and discharge of pump. Pipe to gage.

C. Install pressure gages with pulsation dampers. Provide gage cock to isolate each gage. Extend nipples to allow clearance from insulation.

D. Install thermometers in piping systems in sockets in short couplings or as required to accomodate location in an existing pipe where indicated. Ensure sockets allow clearance from insulation.

E. Provide instruments with scale ranges selected according to service with largest appropriate scale.

F. Install gages and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

G. Adjust gages and thermometers to final angle, clean windows and lenses, and calibrate to zero.

3.02 SCHEDULE

A. Pressure Gages, Location and Scale Range:
   1. Pumps and chiller, 0 to 60 psi. For chiller, use existing tappings inside plant building, adjacent to expansion tank HB-1-ETO2.

B. Pressure Gage Tappings, Location:
   1. Pump - where indicated.

C. Stem Type Thermometers, Location and Scale Range:
   1. Chiller - inlets and outlets, 0 to 120 degrees F.

D. Thermometer Sockets, Location:
   1. Chiller - where indicated indoors.

END OF SECTION

SECTION 23 05 49

VIBRATION & SEISMIC CONTROLS FOR HVAC

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Intent
   1. All mechanical equipment, piping and ductwork as noted on the equipment schedule or in the specification shall be mounted on vibration isolators to prevent the transmission of vibration and mechanically transmitted sound to the building structure .
   2. Vibration isolators shall be selected in accordance with the weight distribution so as to produce reasonably uniform deflections.
   3. All mechanical equipment, piping and ductwork as noted on the equipment schedule, in the specification or as required by code shall be held in place during a seismic event.

1.02 SUBMITTALS

A. See Section 01 30 00 - Submittal Procedures for submittal procedures.

B. The manufacturer of vibration isolation and seismic restraints shall provide submittals for products as follows:
   1. Descriptive Data:
      a. Catalog cuts or data sheets on vibration isolators and specific restraints detailing compliance with the specification.
      b. Detailed schedules of flexible and rigidly mounted equipment, showing vibration isolators and seismic restraints by referencing numbered descriptive drawings.
      c. Shop Drawings:
         1) Submit fabrication details for equipment bases including dimensions, structural member sizes and support point locations.
         2) Provide all details of suspension and support for ceiling hung equipment.
         3) Where walls, floors, slabs or supplementary steel work are used for seismic restraint locations, details of acceptable attachment methods for ducts, conduit and pipe shall be included and approved before the condition is accepted for installation. Restraint manufacturers' submittals shall include spacing, static loads and seismic loads at all attachment and support points.
         4) Provide specific details of seismic restraints and anchors; include number, size and locations for each piece of equipment.
      d. Seismic Certification and Analysis:
         1) Seismic restraint calculations shall be provided for all connections of equipment to structure. Calculations shall be stamped by a registered professional engineer with at least five years of seismic design experience, licensed in the state of the job location.
         2) All restraining devices shall have a preapproval number from California OSHPD or another recognized government agency showing maximum restraint ratings. Where pre-approved devices are not available, submittals based on independent testing or calculations stamped by a registered professional engineer with at least five years of seismic design experience and licensed in the state of the job location are required.

C. Contractor shall provide to the Marion County Building and Permit Services Department as Supplemental Information all seismic details and calculations for equipment required as indicated. This information is required before Permits can be issued. Any additional permit fees will be covered by County. Where details are the same at multiple installations, copies may be submitted. Where new roof curbs are installed, details and calculations shall include attachment of curb to structure as well as attachment of equipment to curb. Where adaptor curbs are installed details and calculations shall include attachment of adaptor curb to existing curb as well as attachment of equipment to adaptor curb.

1.03 REGULATORY REQUIREMENTS

A. Typical Applicable Codes and Standards
   1. Seismic design shall be in accordance with the 2014 Oregon Structural Specialty Code.
   2. ACSE 7-05 as referenced in OSSC 2014.

1.04 MANUFACTURER'S RESPONSIBILITY

A. Manufacturer of vibration isolation and seismic control equipment shall have the following responsibilities:
   1. Determine vibration isolation and seismic restraint sizes and locations.
   2. Provide vibration isolation and seismic restraints as scheduled or specified.
   3. Provide calculations and materials if required for restraint of non-isolated equipment.
   4. Provide installation instructions, drawings and trained field supervision to insure proper installation and performance.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Mason Industries, as basis of design

B. Thybar; Model Vibro-Curb III: www.thybar.com.

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

2.02 PRODUCT DESCRIPTIONS

A. Seismic Restraints
   1. SPECIFICATION 12: Seismic sway braces shall consist of galvanized steel aircraft cables or steel angles/channels. Cables braces shall be designed to resist seismic tension loads and steel braces shall be designed to resist both tension and compression loads with a minimum safety factor of 2. Brace end connections shall be steel assemblies that swivel to the final installation angle. Rod braces when required shall be clamped to the threaded hanger rods at the seismic sway brace locations utilizing a minimum of two ductile iron clamps. Do not mix cable and steel braces on the same system or equipment. Brace assemblies and rod clamps shall have an Anchorage Preapproval "OPA" Number from OSHPD in the State of California verifying the maximum certified load ratings. Cable brace assemblies shall be Type SCB or SCBH, steel brace assemblies shall be Type SSB, SSBS or SSRF, and rod clamps shall be Type UC all as manufactured by Mason Industries, Inc.

B. Isolation Systems
   1. SPECIFICATION 22: Curb mounted rooftop equipment shall be mounted on spring isolation curbs as scheduled in this specificatio section. The upper frame shall provide continuous support for the equipment and shall be captive so as to resiliently resist wind and seismic forces. All directional neoprene snubber bushings shall be a minimum of 1/4" thick. Steel springs shall be laterally stable and rest on 1/4" thick neoprene acoustical pads. Hardware shall be plated and the springs provided with a rust resistant finish. Prefabricated Vibration isolation curb to be manufactured of prime galvanized steel construction, 18 or 14 gauge as required, meeting ASTM A653/653M, with welded corners and with seams joined by continuous water and air tight welds. Vibration isolation curb shall be internally reinforced with bulkheads 48” on center and factory installed wood nailer. Top of all Vibration isolation curb shall be level, with pitch built into curb when deck slopes. Vibration isolation curb shall be designed to provide a minimum of 90% isolation efficiency with 1” deflection. 9” continuous rubber cover around perimeter of Vibration isolation curb over spring isolators. Lower curbs shall have provision for 3" of insulation. The roof curbs shall be built to seismically contain the rooftop unit. The unit shall be solidly fastened to the top floating rail, and the lower section anchored to the roof structure. Curb shall have anchorage preapproval "OPA" from OSHPD in the state of California attesting to the maximum certified horizontal and vertical load ratings. Curb shall be type Vibro-Curb III as manufactured by Thybar Corp.

PART 3 - EXECUTION

3.01 GENERAL

A. All vibration isolators and seismic restraint systems shall be installed in strict accordance with the manufacturer's written instructions and all certified submittal data.

B. Installation of vibration isolators and seismic restraints shall not cause any change of position of equipment, piping or ductwork resulting in stresses or misalignment.

C. No rigid connections between equipment and the building structure shall be made that degrades the noise and vibration control system herein specified.

D. Any conflicts with other trades which will result in rigid contact with equipment or piping due to inadequate space or other unforeseen conditions should be brought to the architects/engineers attention prior to installation. Corrective work necessitated by conflicts after installation shall be at the responsible contractor's expense.

E. All mechanical equipment, piping and ductwork as noted on the equipment schedule, in the specification or as required by code shall be held in place during a seismic event.

3.02 SEISMIC BRACING REQUIREMENTS

A. Mechanical and electrical components shall meet the requirements of OSSC 2014 as noted in this section.

B. Requirements vary for systems with Ip=1.0 or 1.5. All components shall be assigned a component importance factor, Ip equal to 1.0 except the component importance factor Ip shall be taken as 1.5 where any of the following conditions apply:
   1. The component is required to function for life-safety purposes after an earthquake, including fire protection sprinkler systems.
   2. The component contains hazardous materials.
   3. The component is in or attached to an Occupancy Category IV structure and it is needed for continued operation of the facility or its failure could impair the continued operation of the facility.

   Occupancy Categories are defined in OSSC 2014 Table 1604.5

C. For the purpose of this project ductile pipe is copper, steel, aluminum and cast iron no-hub pipe joined with approved elastomeric couplings.

D. Components suspended from above are not required to meet the requirements of this section provided that they cannot be damaged or cannot damage any other component when subject to seismic motion and they have ductile or articulating connections to the structure at the point of attachment. The gravity design load for these items shall be three times their operating load.

E. Seismic restraints can be excluded from the following when Ip=1.0:
   1. Mechanical and electrical components where flexible connections are provided between the components and associated ductwork, piping and conduit, and the system components are mounted at 4 ft. or less above floor or roof level and weigh 400 lbs. or less.
   2. Mechanical and electrical components weighing 75 lbs. or less where flexible connections are provided between the components and associated ductwork, piping and conduit.
   3. Piping, ductwork and electrical distribution systems weighing 5 lbs./ft or less where flexible connectors are provided between the component and the piping, ductwork or electrical distribution system.
   4. Suspended HVAC ducts provided they meet either of the following conditions for the entire run of duct, the hangers are 12 in. or less in length from the top of duct to the supporting structure detailed to avoid significant bending to the hangers or their connections or the cross-sectional area is less than 6 ft2 .
   5. Ductile piping with a nominal pipe size of 3 in. or less.

F. Seismic restraints can be excluded from the following when Ip=1.0 or 1.5:
   1. Equipment items installed in-line with the duct system (e.g. fans, heat exchangers, and humidifiers) with an operating weight equal to or less than 75 lbs. Unbraced piping

attached to in-line equipment shall be provided with adequate flexibility to accommodate differential displacements.

2. Piping supported by rod hangers provided that all hangers in the pipe run are 12 in. or less in length from the top of the pipe to the supporting structure and the pipe can accommodate the expected deflections. Rod hangers shall not be constructed in a manner that would subject the rod to bending moments.

G. Additional requirements for ductwork systems designated with an Ip=1.5:
   1. In addition to attachment and supports, ductwork systems designated as having an Ip=1.5 themselves shall be designed to meet the force and displacement requirements of this section.
   2. HVAC duct systems fabricated and installed according to approved standards meet the lateral bracing requirements of this section, include brace exclusions for ductwork under 6 sq. ft. area, ductwork supported 12” or less from the structure.

H. Additional requirements for piping systems designated with an Ip=1.5:
   1. Seismic braces can be excluded from ductile piping with Ip=1.5 and a nominal pipe size of 1 in. or less where provisions are made to protect the piping from impact of larger piping or other equipment.
   2. In addition to attachment and supports, piping systems designated as having an Ip=1.5 themselves shall be designed to meet the force and displacement requirements of this section.
   3. Piping designated as having an Ip=1.5, but not designed in accordance with ASME B31 shall meet the maximum stress levels shown in ASCE 7-05 and shall have adequate flexibility between support attachment points to the structure, ground, equipment or other piping.

I. Consider additional Fp factors:
   1. The resulting seismic force calculated from the above equations and tables is based on design strength loads. Initial use of these forces conflicts with the data available for the anchorage components used to resist the seismic forces that are based on allowable stress design (working stress design). Unless design strength values for anchor components are available, divide the resulting seismic force by 1.4 before designing the anchoring component.
   2. Components mounted on vibration isolation systems shall have bumper restraint or snubber in each horizontal direction. If the maximum clearance (air gap) between the equipment support frame and the restraint is greater than 1/4” the design force shall be taken as 2xFp. If the maximum clearance specified on the construction documents is 1/4", the design force may be taken as Fp .
   3. Where component anchorage is provided by shallow expansion anchors, shallow chemical anchors or shallow cast-in-place anchors (where embedment is less than 8xD) a value of Rp=1.5 shall be used.
   4. Anchors embedded in concrete shall be designed for 1.3 times the force.

J. Consider additional requirements:
   1. The design strength of anchors in concrete shall be determined in accordance with ACI-318-02; the only post-installed anchors currently meeting ACI-318-02 requirements are Hilti HDA, HSL and Kwik Bolt TZ.
   2. Expansion anchors shall not be used for mechanical equipment rated over 10 hp unless vibration isolators are provided.
   3. Mechanical and electrical components shall meet the force and seismic relative displacement requirements. Design drift can be taken as 1% of the story height. For example, differential motion from floor to ceiling for a 20’ story height is 2.4 inches. Suspended piping and ductwork attached to floor mounted equipment shall have the inherent flexibility or flexible connectors to allow differential motion without overloading the component connection.
   4. Mechanical and electrical components shall be designed to resist seismic forces. Components with an Ip=1.5 which shall remain operable shall demonstrate operability by

shake table testing or experience data. The manufacturer's certificate of compliance shall be submitted to the authority having jurisdiction. Additional requirements for a quality assurance plan, special inspection and certification requirements are in OSSC 2014.

3.03 EQUIPMENT SCHEDULE

A. Air terminal units: Specification 12.

B. REF-1 and REF-2:
   1. Specificaton 22.
   2. Provide seismic attachment to structure or roof curb.

END OF SECTION

SECTION 23 05 53
IDENTIFICATION FOR HVAC EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Pipe Markers.

D. Ceiling Markers.

1.02 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; The American Society of Mechanical Engineers; 2007.

B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials; 2013.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.

C. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

D. Product Data: Provide manufacturers catalog literature for each product required.

E. Project Record Documents: Record actual locations of tagged valves.

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

A. Air Terminal Units: Tags.

B. Automatic Controls: Tags. Key to control schematic.

C. Control Panels: Nameplates.

D. Major Control Components: Nameplates.

E. Piping: Pipe markers.

F. Pumps: Nameplates.

G. Small-sized Equipment: Tags.

H. Thermostats: Nameplates.

I. Valves: Tags .

2.02 NAMEPLATES

A. Manufacturers:
   1. Advanced Graphic Engraving: www.advancedgraphicengraving.com.
   2. Kolbi Pipe Marker Co.: www.kolbipipemarkers.com.
   3. Seton Identification Products: www.seton.com.

B. Description: Laminated three-layer plastic with engraved letters.
   1. Letter Color: White.
   2. Letter Height: 1/4 inch.
   3. Background Color: Black.

2.03 TAGS

A. Manufacturers:
   1. Advanced Graphic Engraving; Model _____: www.advancedgraphicengraving.com.
   2. Brady Corporation; Model _____: www.bradycorp.com.
   3. Kolbi Pipe Marker Co.; Model _____: www.kolbipipemarkers.com.

4. Seton Identification Products; Model _____: www.seton.com.

B. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.

C. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

D. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.04 PIPE MARKERS

A. Manufacturers:
1. Brady Corporation; Model _____: www.bradycorp.com.
2. Kolbi Pipe Marker Co.; Model _____: www.kolbipipemarkers.com.
3. MIFAB, Inc.; Model _____: www.mifab.com.
4. Seton Identification Products; Model _____: www.seton.com.

B. Color: Conform to ASME A13.1.

C. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

D. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

E. Color code as follows:
1. Cooling: Green with white letters.

2.05 CEILING TACKS

A. Manufacturers:
1. Craftmark; Model _____: www.craftmarkid.com.

B. Description: Round adhesive stickers, color coded.

C. Color code as follows:
1. HVAC Equipment: Yellow.
2. Fire Dampers and Smoke Dampers: Red.

PART 3 EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION

A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain.

C. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

D. Use tags on piping 3/4 inch diameter and smaller.
1. Identify service, flow direction, and pressure.
2. Install in clear view and align with axis of piping.
3. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

E. Identify air handling units, pumps, heat transfer equipment, tanks, and water treatment devices with plastic nameplates. Small devices, such as in-line pumps, may be identified with tags.

F. Identify valves in main and branch piping with tags. Tag is not required for equipment isolation valves when valve is located within 6 feet of equipment.

G. Identify air terminal units and radiator valves with numbered tags.

H. Identify piping, concealed or exposed, with plastic tape pipe markers. Use tags on piping 3/4 inch diameter and smaller. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

I. Install ductwork with plastic nameplates. Identify with air handling unit identification number and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.

J. Provide ceiling markers to locate fan coil units, terminal units, or dampers above T-bar type panel ceilings. Locate on grid near equipment.

K. Provide ceiling tacks to locate, terminal units, or dampers above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION

SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Testing, adjustment, and balancing of completed air systems.

B. Testing, adjustment, and balancing of completed hydronic systems

C. Measurement of final operating condition of HVAC systems.

D. Commissioning activities.

1.02 RELATED REQUIREMENTS

A. Section 01 91 13: Commissioning requirements that apply to all types of work.

B. Section 23 08 00 - Commissioning of HVAC.

1.03 REFERENCE STANDARDS

A. AABC MN-1 - AABC National Standards for Total System Balance; Associated Air Balance Council; 2002.

B. ASHRAE Std 111 - Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.; 2008.

C. NEBB (TAB) - Procedural Standards for Testing Adjusting Balancing of Environmental Systems; National Environmental Balancing Bureau; 2005, Seventh Edition.

D. SMACNA (TAB) - HVAC Systems Testing, Adjusting, and Balancing; Sheet Metal and Air Conditioning Contractors' National Association; 2002.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Installer Qualifications: Submit name of adjusting and balancing agency and TAB supervisor for approval within 30 days after award of Contract.

C. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.
   1. Submit to Engineer.
   2. Submit to the Commissioning Authority.
   3. Submit six weeks prior to starting the testing, adjusting, and balancing work.
   4. Include certification that the plan developer has reviewed the contract documents, the equipment and systems, and the control system with the Engineer and other installers to sufficiently understand the design intent for each system.
   5. Include at least the following in the plan:
      a. Preface: An explanation of the intended use of the control system.
      b. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
      c. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
      d. Identification and types of measurement instruments to be used and their most recent calibration date.
      e. Discussion of what notations and markings will be made on the duct and piping drawings during the process.
      f. Final test report forms to be used.
      g. Details of how TOTAL flow will be determined; for example:
         1) Air: Sum of terminal flows via control system calibrated readings or via hood readings of all terminals, supply (SA) and return air (RA) pitot traverse, SA or RA flow stations.

2) Water: Pump curves, circuit setter, flow station, ultrasonic, etc.

h. Specific procedures that will ensure that both air and water side are operating at the lowest possible pressures and methods to verify this.
i. Confirmation of understanding of the outside air ventilation criteria under all conditions.
j. Method of verifying and setting minimum outside air flow rate will be verified and set and for what level (total building, zone, etc.).
k. Method of checking building static and exhaust fan and/or relief damper capacity.
l. Methods for making coil or other system plant capacity measurements, if specified.
m. Exhaust fan balancing and capacity verifications, including any required room pressure differentials.
n. Procedures for field technician logs of discrepancies, deficient or uncompleted work by others, contract interpretation requests and lists of completed tests (scope and frequency).
o. Procedures for formal progress reports, including scope and frequency.
p. Procedures for formal deficiency reports, including scope, frequency and distribution.

D. Field Logs: Submit at least once a week to Commissioning Authority.

E. Progress Reports.

F. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
1. Submit to the Construction Manager within two weeks after completion of testing, adjusting, and balancing.
2. Revise TAB plan to reflect actual procedures and submit as part of final report.
3. Submit electronic draft copy of report for review by Mechanical Engineer 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 actual instrument list, with manufacturer name, serial number, and date of calibration.
6. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
7. Units of Measure: Report data in I-P (inch-pound) units only.
8. Test Reports: Indicate data on AABC-MN-1 forms, forms perpared following ASHRAE Std 111, or NEBB forms.
9. 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.
g. Project Engineer.
h. Project Contractor.
i. Project altitude.
j. Report date.

G. Project Record Documents: Record actual locations of balancing valves and rough setting.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. Perform total system balance in accordance with one of the following:
   1. AABC MN-1, AABC National Standards for Total System Balance.
   2. NEBB Procedural Standards for Testing Adjusting Balancing of Environmental Systems.
   3. SMACNA (TAB).
   4. Maintain at least one copy of the standard to be used at project site at all times.

B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.

C. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with the authorities having jurisdiction.

D. TAB Agency Qualifications:
   1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
   2. Having minimum of three years documented experience.
   3. Certified by one of the following:
      a. AABC, Associated Air Balance Council: www.aabchq.com; upon completion submit AABC National Performance Guaranty.
      b. NEBB, National Environmental Balancing Bureau: www.nebb.org.
      c. TABB, The Testing, Adjusting, and Balancing Bureau of National Energy Management Institute: www.tabbcertified.org.

E. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

3.02 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 that will or could prevent proper system balance.

C. Beginning of work means acceptance of existing conditions.

3.03 PREPARATION

A. Hold a pre-balancing meeting at least one week prior to starting TAB work.
   1. Require attendance by all installers whose work will be tested, adjusted, or balanced.

B. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Engineer to facilitate spot checks during testing.

C. Provide additional balancing devices as required.

3.04 ADJUSTMENT TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.

B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

C. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

3.05 RECORDING AND ADJUSTING

A. Field Logs: Maintain written logs including:
   1. Running log of events and issues.
   2. Discrepancies, deficient or uncompleted work by others.
   3. Contract interpretation requests.
   4. Lists of completed tests.

B. Ensure recorded data represents actual measured or observed conditions.

C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

D. Mark on the drawings the locations where traverse and other critical measurements were taken and cross reference the location in the final report.

E. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

F. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

G. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by the Owner.

3.06 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 distribution system to obtain uniform space temperatures free from objectionable drafts and noise.

E. Use volume control devices to regulate air quantities only to extend 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. 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.

H. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

I. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

J. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable air volume terminal unit air flows at duct static pressure conditions

typical of similar systems (1.0" to 1.5" wc). Balance air outlets for each terminal unit at cooling maximum air flow and heating minimum air flow.

K. Measure leaving air temperature from SCR-controlled electric reheat coil in heating minimum and heating maximum air flow rates. Insure that maximum temperature does not exceed 120 deg. F under any conditions.

L. Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 0.05 inches positive static pressure near the building entries.

3.07 WATER SYSTEM PROCEDURE

A. Adjust water systems to provide required or design quantities.

B. Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gauges to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.

C. Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.

D. Effect system balance with automatic control valves fully open to heat transfer elements.

E. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.

F. Where available pump capacity is less than total flow requirements or individual system parts, full flow in one part may be simulated by temporary restriction of flow to other parts.

3.08 COMMISSIONING

A. See Sections 01 91 13 and 23 08 00 for additional requirements.

B. Perform prerequisites prior to starting commissioning activities.

C. Fill out Prefunctional Checklists for:
   1. Air side systems.
   2. Water side systems.

D. Furnish to the Commissioning Authority, upon request, any data gathered but not shown in the final TAB report.

E. Re-check minimum outdoor air intake flows and maximum and intermediate total airflow rates for 100 percent of the air handlers plus a random sample equivalent to 10 percent of the final TAB report data as directed by Commissioning Authority.
   1. Original TAB agency shall execute the re-checks, witnessed by the Commissioning Authority.
   2. Use the same test instruments as used in the original TAB work.
   3. Failure of more than 10 percent of the re-checked items of a given system shall result in the rejection of the system TAB report; rebalance the system, provide a new system TAB report, and repeat random re-checks.
   4. For purposes of re-check, failure is defined as follows:
      a. Air Flow of Supply and Return: Deviation of more than 10 percent of instrument reading.
      b. Minimum Outside Air Flow: Deviation of more than 20 percent of instrument reading; for inlet vane or VFD OSA compensation system using linear proportional control, deviation of more than 30 percent at intermediate supply flow.
      c. Temperatures: Deviation of more than one degree F.
      d. Air and Water Pressures: Deviation of more than 10 percent of full scale of test instrument reading.
   5. For purposes of re-check, a whole system is defined as one in which inaccuracies will have little or no impact on connected systems; for example, the air distribution system served by one air handler or the hydronic chilled water supply system served by a chiller or the condenser water system.

F. In the presence of the Commissioning Authority, verify that:
   1. Final settings of all valves, splitters, dampers and other adjustment devices have been permanently marked.
   2. The air system is being controlled to the lowest possible static pressure while still meeting design loads, less diversity; this shall include a review of TAB methods, established control setpoints, and physical verification of at least one leg from fan to diffuser having all balancing dampers wide open and that during full cooling of all terminal units taking off downstream of the static pressure sensor, the terminal unit on the critical leg has its damper 90 percent or more open.
   3. The water system is being controlled to the lowest possible pressure while still meeting design loads, less diversity; this shall include a review of TAB methods, established control setpoints, and physical verification of at least one leg from the pump to the coil having all balancing valves wide open and that during full cooling the cooling coil valve of that leg is 90 percent or more open.

3.09 SCOPE

A. Test, adjust, and balance the following:
   1. HVAC Pumps
   2. Air Cooled Water Chillers
   3. Air Coils
   4. Terminal Heat Transfer Units
   5. Air Handling Units
   6. Fans
   7. Air Filters
   8. Air Terminal Units
   9. Air Inlets and Outlets

3.10 MINIMUM DATA TO BE REPORTED

A. 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/Bore

B. 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 actual

C. Pumps:
   1. Identification/number
   2. Manufacturer
   3. Size/model
   4. Impeller
   5. Service
   6. Design flow rate, pressure drop, BHP
   7. Actual flow rate, pressure drop, BHP
   8. Discharge pressure
   9. Suction pressure

10. Total operating head pressure
11. Shut off, discharge and suction pressures
12. Shut off, total head pressure

D. Chillers:
1. Identification/number
2. Manufacturer
3. Capacity
4. Model number
5. Serial number
6. Evaporator entering water temperature, design and actual
7. Evaporator leaving water temperature, design and actual
8. Evaporator pressure drop, design and actual
9. Evaporator water flow rate, design and actual
10. Condenser entering water temperature, design and actual
11. Condenser pressure drop, design and actual
12. Condenser water flow rate, design and actual

E. Cooling Coils:
1. Identification/number
2. Location
3. Manufacturer
4. Air flow, design and actual
5. Entering air DB temperature, design and actual
6. Entering air WB temperature, design and actual
7. Leaving air DB temperature, design and actual
8. Leaving air WB temperature, design and actual
9. Water flow, design and actual
10. Water pressure drop, design and actual
11. Entering water temperature, design and actual
12. Leaving water temperature, design and actual

F. Air Moving Equipment:
1. Location
2. Manufacturer
3. Model number
4. Serial number
5. Arrangement/Class/Discharge
6. Air flow, specified and actual
7. Return air flow, specified and actual
8. Outside air flow, specified and actual
9. Total static pressure (total external), specified and actual
10. Inlet pressure
11. Discharge pressure
12. Sheave Make/Size/Bore
13. Number of Belts/Make/Size
14. Fan RPM

G. Return Air/Outside Air:
1. Identification/location
2. Design air flow
3. Actual air flow
4. Design return air flow
5. Actual return air flow
6. Design outside air flow
7. Actual outside air flow
8. Return air temperature

9. Outside air temperature
10. Design outside/return air ratio
11. Actual outside/return air ratio

H. Exhaust Fans:
1. Location
2. Manufacturer
3. Model number
4. Serial number
5. Air flow, specified and actual
6. Total static pressure (total external), specified and actual
7. Inlet pressure
8. Discharge pressure
9. Sheave Make/Size/Bore
10. Number of Belts/Make/Size
11. Fan RPM

I. 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

J. 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 design air flow
9. Maximum design air flow
10. Maximum actual air flow
11. Inlet static pressure

K. Air Distribution Tests:
1. Air terminal number
2. Terminal type
3. Terminal size
4. Design air flow
5. Test (final) air flow
6. Percent of design air flow

END OF SECTION

SECTION 23 07 13
DUCT INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Duct insulation.

B. Duct liner.

C. Insulation jackets.

1.02 RELATED REQUIREMENTS

A. Section 23 05 53 - Identification for HVAC Equipment.

B. Section 23 31 00 - HVAC Ducts and Casings: Glass fiber ducts.

1.03 REFERENCE STANDARDS

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

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

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

D. ASTM C916 - Standard Specification for Adhesives for Duct Thermal Insulation; 1985 (Reapproved 2007).

E. ASTM C1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material); 2012.

F. ASTM C1290 - Standard Specification for Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts; 2011.

G. ASTM C1338 - Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings; 2008.

H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2014.

I. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2014.

J. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2013.

K. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association; 2006.

L. SMACNA (DCS) - HVAC Duct Construction Standards; Sheet Metal and Air Conditioning Contractors' National Association; 2005.

M. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

C. Manufacturer's Instructions: Indicate installation procedures necessary to ensure acceptable workmanship and that installation standards will be achieved.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section with not less than three years of documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section, with minimum three years of experience and approved by manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.07 FIELD CONDITIONS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.01 REQUIREMENTS FOR ALL PRODUCTS OF THIS SECTION

A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84, NFPA 255, or UL 723.

2.02 GLASS FIBER, FLEXIBLE

A. Manufacturer:
   1. Knauf Fiber GlassDuct Wrap
   2. Johns Manville CorporationMicrolite
   3. Owens Corning CorpSoftR
   4. CertainTeed CorporationSoftTouch

B. Insulation: ASTM C553; flexible, noncombustible blanket.
   1. 'K' value:.27 at 75 degrees F, when tested in accordance with ASTM C518.
   2. Maximum Water Vapor Sorption: 5.0 percent by weight.
   3. Maximum Service Temperature: 250 degrees F.

C. Vapor Barrier Jacket:
   1. Moisture Vapor Permeability: 0.029 ng/Pa s m (0.02 perm inch), when tested in accordance with ASTM E96/E96M.
   2. Secure with pressure sensitive tape.

D. Vapor Barrier Tape:
   1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

E. Tie Wire: Annealed steel, 16 gage, 0.0508 inch diameter.

2.03 GLASS FIBER, RIGID

A. Insulation: ASTM C612; rigid, noncombustible blanket.
   1. 'K' value: 0.24 at 75 degrees F, when tested in accordance with ASTM C518.
   2. Maximum Water Vapor Sorption: 5.0 percent.
   3. Maximum Density: 8.0 lb/cu ft.

B. Vapor Barrier Jacket:
   1. Moisture Vapor Permeability: 0.029 ng/Pa s m (0.02 perm inch), when tested in accordance with ASTM E96/E96M.

2.04 JACKETS

A. Canvas Jacket: UL listed 6 oz/sq yd plain weave cotton fabric treated with dilute fire retardant lagging adhesive.

2.05 RECTANGULAR DUCT LINER

A. Manufacturers:
   1. Knauf Fiber Glass: Duct LIner EM

2. Johns Manville Corporation: Linacoustic RC
3. Owens Corning Corp: QuietR Acoustic Duct Liner.
4. CertainTeed Corporation: ToughgardR Duct Liner

B. Insulation: Incombustible glass fiber complying with ASTM C 1071; flexible blanket; impregnated surface and edges coated with poly vinyl acetate polymer or acrylic polymer shown to be fungus and bacteria resistant by testing to ASTM G 21.
1. Apparent Thermal Conductivity: Maximum of 0.31 at 75 degrees F.
2. Service Temperature: Up to 250 degrees F.
3. Rated Velocity on Coated Air Side for Air Erosion: 5,000 fpm, minimum.
4. Minimum Noise Reduction Coefficients:
   a. 1/2 inch Thickness: 0.30.
   b. 1 inch Thickness: 0.45.
   c. 1-1/2 inches Thickness: 0.60.
   d. 2 inch Thickness: 0.70.
5. Color: Black face when used in return air boot.

C. Adhesive: Waterproof, fire-retardant type, ASTM C916.

D. Liner Fasteners: Galvanized steel, self-adhesive pad with integral head.

2.06 ROUND DUCT LINER

A. Manufacturers:
1. Manville Spiracoustic Plus VSD
2. Owens Corning Quiet Zone
3. United McGill Double-Wall Acousti K-27
4. United McGill Single-Wall with Acousti-line liner

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that ducts have been tested before applying insulation materials.

B. Verify that surfaces are clean, foreign material removed, and dry.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Insulated ducts conveying air below ambient temperature:
1. Provide insulation with vapor barrier jackets.
2. Finish with tape and vapor barrier jacket.
3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.

D. Ducts Exposed in Mechanical Equipment Rooms or Finished Spaces (below 10 feet above finished floor): Finish with canvas jacket sized for finish painting.

E. Duct Liner Application:
1. Adhere insulation with adhesive for 90 percent coverage.
2. Secure insulation with mechanical liner fasteners. Refer to SMACNA (DCS) for spacing.
3. Seal and smooth joints. Seal and coat transverse joints.
4. Seal liner surface penetrations with adhesive.
5. Duct dimensions indicated are net inside dimensions required for air flow. Increase duct size to allow for insulation thickness.

3.03 SCHEDULES

A. Supply Ducts: Exterior wrap, minimum installed R value per OSSC Chapter 13.

B. Existing Supply Ducts to Remain: Exterior wrap where existing insulation is missing, minimum installed R value per OSSC Chapter 13.

C. Return Ducts within 2 feet of return air grilles: Liner, 1 inch.

END OF SECTION

SECTION 23 07 19
HVAC PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping insulation.

B. Jackets and accessories.

1.02 RELATED REQUIREMENTS

A. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 07 84 00 - Firestopping.

C. Section 09 91 23 - Interior Painting: Painting insulation jacket.

D. Section 23 21 13 - Hydronic Piping: Placement of hangers and hanger inserts.

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 C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded Hot Plate Apparatus; 2013.

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

F. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation; 2013.

G. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2014.

H. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2015.

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

J. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2013.

K. ASTM C585 - Standard Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System); 2010.

L. ASTM C591 - Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation; 2013.

M. ASTM D1056 - Standard Specification for Flexible Cellular Materials--Sponge or Expanded Rubber; 2014.

N. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2014.

O. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2014.

P. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 30 00 - Submittal Procedures, for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum _____ years of experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.07 FIELD CONDITIONS

A. Maintain ambient conditions required by manufacturers of each product.

B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS

2.01 REQUIREMENTS FOR PRODUCTS OF THIS SECTION

A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER

A. Manufacturers:
   1. Knauf Insulation; Model _____: www.knaufusa.com.
   2. Knauf Earthwool; Model _____: www.knaufusa.com.
   3. Owens Corning Corp SSL II
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible, with wicking material to transport condensed water to the outside of the system for evaporation to the atmosphere.
   1. 'K' Value: ASTM C177, 0.23 at 75 degrees F.
   2. Maximum Service Temperature: 220 degrees F.
   3. Maximum Moisture Absorption: 0.2 percent by volume.

C. Vapor Barrier Jacket: White kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E 96/E 96M of 0.02 perm-inches, with self-sealing longitudinal closure laps (SSL) and butt strips. Shall comply with Oregon Revised Statute 853.085 by containing less than 0.10% decabromodiphenyl ether by mass.

D. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.

E. Vapor Barrier Lap Adhesive: Compatible with insulation.

F. Indoor Vapor Barrier Finish:
   1. Cloth: Untreated; 9 oz/sq yd weight.

2.03 HYDROUS CALCIUM SILICATE

A. Manufacturers:
   1. IIG Thermo-12 Gold
   2. Pabco
   3. Substitutions: See Section 01 60 00 - Product Requirements.

B. Insulation: ASTM C533 and ASTM C795; rigid molded, asbestos free, gold color.
   1. 'K' value: ASTM C177 and C518; 0.40 at 300 degrees F, when tested in accordance with ASTM C177 or ASTM C518.
   2. Maximum service temperature: 1200 degrees F.
   3. Density: 15 lb/cu ft.

2.04 POLYETHYLENE

A. Manufacturers:

1. Armacell Tubolit
2. Substitutions: See Section 01 60 00 - Product Requirements.

B. Insulation: Flexible closed-cell polyethylene tubing, slit lengthwise for installation, complying with applicable requirements of ASTM D1056.
1. 'K' value: ASTM C177; 0.25 at 75 degrees F.
2. Maximum Service Temperature: 300 degrees F.
3. Density: 2 lb/cu ft.
4. Maximum Moisture Absorption: 1.0 percent by volume.
5. Moisture Vapor Permeability: 0.05 perm inch, when tested in accordance with ASTM E96/E96M.
6. Connection: Contact adhesive.

2.05 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturer:
1. Armacell International AP Armaflex
2. K-Flex Insultube
3. Substitutions: See Section 01 60 00 - Product Requirements.

B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 3; use molded tubular material wherever possible.
1. Minimum Service Temperature: Minus 40 degrees F.
2. Maximum Service Temperature: 220 degrees F.
3. Connection: Waterproof vapor barrier adhesive.

C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

2.06 JACKETS

A. PVC Plastic Valve and Fitting Covers
1. Manufacturers:
a. Johns Manville Corporation Zeston 2000 Series
b. Knauf Proto
c. Speedline
d. Substitutions: See Section 01 60 00 - Product Requirements.
2. Jacket: One piece molded type fitting covers and sheet material, off-white color.
a. Minimum Service Temperature: 0 degrees F.
b. Maximum Service Temperature: 150 degrees F.
c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
d. Thickness: 10 mil.
e. Connections: Pressure sensitive color matching vinyl tape, tacks or welding adhesive.

B. Fiberglass Valve Covers
1. Description: Woven fiberglass jacketing around 2” thick fiberglass batt.
2. Attachment: Stainless steel wire and lacing hooks.

2.07 JACKETS FOR EXTERIOR USE

A. Aluminum Jacket: ASTM B209 (ASTM B209M) formed aluminum sheet.
1. Thickness: 0.016 inch sheet.
2. Finish: Smooth.
3. Joining: Longitudinal slip joints and 2 inch laps.
4. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
5. Metal Jacket Bands: 3/8 inch wide; 0.010 inch thick stainless steel.

B. Stainless Steel Jacket: ASTM A666, Type 304 stainless steel.
1. Thickness: 0.010 inch.
2. Finish: Smooth.
3. Metal Jacket Bands: 3/8 inch wide; 0.010 inch thick stainless steel.

2.08 INSERTS AND SHIELDS

A. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.

B. Insert configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.

C. Insert material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Exposed Piping: Locate insulation and cover seams in least visible locations.

D. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.

E. Glass fiber insulated pipes conveying fluids below ambient temperature:
   1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Ensure that jacket vapor barrier is not broken at hangers, clamps, and inserts.
   2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.

F. Inserts and Shields:
   1. Application: Piping 1-1/2 inches diameter or larger.
   2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
   3. Insert location: Between support shield and piping and under the finish jacket.
   4. Insert configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
   5. Insert material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

G. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Section 07 84 00.

3.03 SCHEDULE

A. Cooling Systems:
   1. Chilled Water Supply and Return: Flexible elastomeric: 1.0 inch thick.

END OF SECTION

SECTION 23 08 00

COMMISSIONING OF HVAC

PART 1 GENERAL

1.01 SUMMARY

A. See Section 01 91 13 - General Commissioning Requirements for overall objectives; comply with the requirements of Section 01 91 13.

B. This section covers the Contractor's responsibilities for commissioning; each subcontractor or installer responsible for the installation of a particular system or equipment item to be commissioned is responsible for the commissioning activities relating to that system or equipment item.

C. The Commissioning Authority (CA) directs and coordinates all commissioning activities and provides Prefunctional Checklists and Functional Test Procedures for Contractor's use.

D. The entire HVAC system is to be commissioned, including commissioning activities for the following specific items:
   1. Control system.
   2. Major and minor equipment items.
   3. Piping systems and equipment.
   4. Ductwork and accessories.
   5. Terminal units.
   6. Variable frequency drives.
   7. Special Ventilation:
      a. AIIR room
   8. Other equipment and systems explicitly identified elsewhere in Contract Documents as requiring commissioning.

E. The Prefunctional Checklist and Functional Test requirements specified in this section are in addition to, not a substitute for, inspection or testing specified in other sections.

1.02 RELATED REQUIREMENTS

A. Section 01 78 00 - Closeout Submittals: Scope and procedures for operation and maintenance manuals and project record documents.

B. Section 01 79 00 - Demonstration and Training: Scope and procedures for Owner personnel training.

C. Section 01 91 13 - General Commissioning Requirements: Commissioning requirements that apply to all types of work.

D. Section 23 09 23 - Direct-Digital Control System for HVAC.

E. Section 23 09 93 - Sequence of Operations for HVAC Controls.

F. Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC.

1.03 REFERENCE STANDARDS

A. ASHRAE Guideline 1.1 - The HVAC Commissioning Process; 2012

1.04 SUBMITTALS

A. Updated Submittals: Keep the Commissioning Authority informed of all changes to control system documentation made during programming and setup; revise and resubmit when substantial changes are made.

B. DRAFT Prefunctional Checklists and Functional Test Procedures for Control System: Detailed written plan indicating the procedures to be followed to test, checkout and adjust the control system prior to full system Functional Testing; include at least the following for each type of equipment controlled:
   1. System name.
   2. List of devices.
   3. Step-by-step procedures for testing each controller after installation, including:

a. Process of verifying proper hardware and wiring installation.
b. Process of downloading programs to local controllers and verifying that they are addressed correctly.
c. Process of performing operational checks of each controlled component.
d. Plan and process for calibrating valve and damper actuators and all sensors.
e. Description of the expected field adjustments for transmitters, controllers and control actuators should control responses fall outside of expected values.

4. Copy of proposed log and field checkout sheets to be used to document the process; include space for initial and final read values during calibration of each point and space to specifically indicate when a sensor or controller has “passed” and is operating within the contract parameters.
5. Description of the instrumentation required for testing.
6. Indicate what tests on what systems should be completed prior to TAB using the control system for TAB work. Coordinate with the Commissioning Authority and TAB contractor for this determination.

C. Startup Reports, Prefunctional Checklists, and Trend Logs: Submit for approval of Commissioning Authority.

D. HVAC Control System O&M Manual Requirements. In addition to documentation specified elsewhere, compile and organize at minimum the following data on the control system:
1. Specific step-by-step instructions on how to perform and apply all functions, features, modes, etc. mentioned in the controls training sections of this specification and other features of this system. Provide an index and clear table of contents. Include the detailed technical manual for programming and customizing control loops and algorithms.
2. Full as-built set of control drawings.
3. Full as-built sequence of operations for each piece of equipment.
4. Full points list; in addition to the information on the original points list submittal, include a listing of all rooms with the following information for each room:
a. Floor.
b. Room number.
c. Room name.
d. Air handler unit ID.
e. Reference drawing number.
f. Air terminal unit tag ID.
g. Heating and/or cooling valve tag ID.
h. Minimum air flow rate.
i. Maximum air flow rate.
5. Full print out of all schedules and set points after testing and acceptance of the system.
6. Full as-built print out of software program.
7. Electronic copy on disk of the entire program for this facility.
8. Marking of all system sensors and thermostats on the as-built floor plan and HVAC drawings with their control system designations.
9. Maintenance instructions, including sensor calibration requirements and methods by sensor type, etc.
10. Control equipment component submittals, parts lists, etc.
11. Warranty requirements.
12. Copies of all checkout tests and calibrations performed by the Contractor (not commissioning tests).
13. Organize and subdivide the manual with permanently labeled tabs for each of the following data in the given order:
a. Sequences of operation.
b. Control drawings.
c. Points lists.
d. Controller and/or module data.
e. Thermostats and timers.

f. Sensors and DP switches.
g. Valves and valve actuators.
h. Dampers and damper actuators.
i. Program setups (software program printouts).

E. Project Record Documents: See Section 01 78 00 for additional requirements.
1. Submit updated version of control system documentation, for inclusion with operation and maintenance data.
2. Show actual locations of all static and differential pressure sensors (air, water and building pressure) and air-flow stations on project record drawings.

F. Draft Training Plan: In addition to requirements specified in Section 01 79 00, include:
1. Follow the recommendations of ASHRAE Guideline 1.
2. Control system manufacturer's recommended training.
3. Demonstration and instruction on function and overrides of any local packaged controls not controlled by the HVAC control system.

G. Training Manuals: See Section 01 79 00 for additional requirements.
1. Provide three extra copies of the controls training manuals in a separate manual from the O&M manuals.

PART 2 PRODUCTS

2.01 TEST EQUIPMENT

A. Provide all standard testing equipment required to perform startup and initial checkout and required functional performance testing; unless otherwise noted such testing equipment will NOT become the property of Owner.

B. Equipment-Specific Tools: Where special testing equipment, tools and instruments are specific to a piece of equipment, are only available from the vendor, and are required in order to accomplish startup or Functional Testing, provide such equipment, tools, and instruments as part of the work at no extra cost to Owner; such equipment, tools, and instruments are to become the property of Owner.

PART 3 EXECUTION

3.01 PREPARATION

A. Cooperate with the Commissioning Authority in development of the Prefunctional Checklists and Functional Test Procedures.

B. Furnish additional information requested by the Commissioning Authority.

C. Prepare a preliminary schedule for HVAC pipe and duct system testing, flushing and cleaning, equipment start-up and testing, adjusting, and balancing start and completion for use by the Commissioning Authority; update the schedule as appropriate.

D. Notify the Commissioning Authority when pipe and duct system testing, flushing, cleaning, startup of each piece of equipment and testing, adjusting, and balancing will occur; when commissioning activities not yet performed or not yet scheduled will delay construction notify ahead of time and be proactive in seeing that the Commissioning Authority has the scheduling information needed to efficiently execute the commissioning process.

E. Put all HVAC equipment and systems into operation and continue operation during each working day of testing, adjusting, and balancing and commissioning, as required.

F. Provide test holes in ducts and plenums where directed to allow air measurements and air balancing; close with an approved plug.

G. Provide temperature and pressure taps in accordance with the contract documents.

3.02 INSPECTING AND TESTING - GENERAL

A. Submit startup plans, startup reports, and Prefunctional Checklists for each item of equipment or other assembly to be commissioned.

B. Perform the Functional Tests directed by the Commissioning Authority for each item of equipment or other assembly to be commissioned.

C. Provide two-way radios for use during the testing.

D. Valve/Damper Stroke Setup and Check:
   1. For all valve/damper actuator positions checked, verify the actual position against the control system readout.
   2. Set pump/fan to normal operating mode.
   3. Command valve/damper closed; visually verify that valve/damper is closed and adjust output zero signal as required.
   4. Command valve/damper open; verify position is full open and adjust output signal as required.
   5. Command valve/damper to a few intermediate positions.
   6. If actual valve/damper position does not reasonably correspond, replace actuator or add pilot positioner (for pneumatics).

E. Isolation Valve or System Valve Leak Check: For valves not by coils.
   1. With full pressure in the system, command valve closed.
   2. Use an ultra-sonic flow meter to detect flow or leakage.

F. Deficiencies: Correct deficiencies and re-inspect or re-test, as applicable, at no extra cost to Owner.

3.03 TAB COORDINATION

A. TAB: Testing, adjusting, and balancing of HVAC.

B. Coordinate commissioning schedule with TAB schedule.

C. Review the TAB plan to determine the capabilities of the control system toward completing TAB.

D. Provide all necessary unique instruments and instruct the TAB technicians in their use; such as handheld control system interface for setting terminal unit boxes, etc.

E. Have all required Prefunctional Checklists, calibrations, startup and component Functional Tests of the system completed and approved by the Commissioning Authority prior to starting TAB.

F. Provide a qualified control system technician to operate the controls to assist the TAB technicians or provide sufficient training for the TAB technicians to operate the system without assistance.

3.04 CONTROL SYSTEM FUNCTIONAL TESTING

A. Prefunctional Checklists for control system components will require a signed and dated certification that all system programming is complete as required to accomplish the requirements of the Contract Documents and the detailed Sequences of Operation documentation submittal.

B. Do not start Functional Testing until all controlled components have themselves been successfully Functionally Tested in accordance with the contract documents.

C. Using a skilled technician who is familiar with this building, execute the Functional Testing of the control system as required by the Commissioning Authority.

D. Functional Testing of the control system constitutes demonstration and trend logging of control points monitored by the control system.
   1. The scope of trend logging is partially specified; trend log up to 50 percent more points than specified at no extra cost to Owner.
   2. Perform all trend logging specified in Prefunctional Checklists and Functional Test procedures.

E. Functionally Test integral or stand-alone controls in conjunction with the Functional Tests of the equipment they are attached to, including any interlocks with other equipment or systems; further testing during control system Functional Test is not required unless specifically indicated below.

F. Demonstrate the following to the Commissioning Authority during testing of controlled equipment; coordinate with commissioning of equipment.
   1. Setpoint changing features and functions.
   2. Sensor calibrations.

G. Demonstrate to the Commissioning Authority:
   1. That all specified functions and features are set up, debugged and fully operable.
   2. That scheduling features are fully functional and setup, including holidays.
   3. That all graphic screens and value readouts are completed.
   4. Correct date and time setting in central computer.
   5. That field panels read the same time as the central computer; sample 10 percent of field panels; if any of those fail, sample another 10 percent; if any of those fail test all remaining units at no extra cost to Owner.
   6. Functionality of field panels using local operator keypads and local ports (plug-ins) using portable computer/keypad; demonstrate 100 percent of panels and 10 percent of ports; if any ports fail, sample another 10 percent; if any of those fail, test all remaining units at no extra cost to Owner.
   7. Power failure and battery backup and power-up restart functions.
   8. Global commands features.
   9. Security and access codes.
   10. Occupant over-rides (manual, telephone, key, keypad, etc.).
   11. O&M schedules and alarms.
   12. Occupancy sensors and controls.
   13. Communications to remote sites.
   14. Fire alarm interlocks and response.
   15. Fire protection and suppression systems interfaces.
   16. Security system interlocks.
   17. All control strategies and sequences not tested during controlled equipment testing.

H. If the control system, integral control components, or related equipment do not respond to changing conditions and parameters appropriately as expected, as specified and according to acceptable operating practice, under any of the conditions, sequences, or modes tested, correct all systems, equipment, components, and software required at no additional cost to Owner.

3.05 OPERATION AND MAINTENANCE MANUALS

A. See Section 01 78 00 for additional requirements.

B. Add design intent documentation furnished by Architect to manuals prior to submission to Owner.

C. Submit manuals related to items that were commissioned to Commissioning Authority for review; make changes recommended by Commissioning Authority.

D. Commissioning Authority will add commissioning records to manuals after submission to Owner.

3.06 DEMONSTRATION AND TRAINING

A. See Section 01 79 00 for additional requirements.

B. Demonstrate operation and maintenance of HVAC system to Owner' personnel; if during any demonstration, the system fails to perform in accordance with the information included in the O&M manual, stop demonstration, repair or adjust, and repeat demonstration. Demonstrations may be combined with training sessions if appropriate.

C. These demonstrations are in addition to, and not a substitute for, Prefunctional Checklists and demonstrations to the Commissioning Authority during Functional Testing.

D. Provide classroom and hands-on training of Owner's designated personnel on operation and maintenance of the HVAC system, control system, and all equipment items indicated to be commissioned. Provide the following minimum durations of training:

E. TAB Review: Instruct Owner's personnel for minimum ____ hours, after completion of TAB, on the following:
   1. Review final TAB report, explaining the layout and meanings of each data type.
   2. Discuss any outstanding deficient items in control, ducting or design that may affect the proper delivery of air or water.
   3. Identify and discuss any terminal units, duct runs, diffusers, coils, fans and pumps that are close to or are not meeting their design capacity.
   4. Discuss any temporary settings and steps to finalize them for any areas that are not finished.
   5. Other salient information that may be useful for facility operations, relative to TAB.

F. HVAC Control System Training: Perform training in at least three phases:
   1. Phase 1 - Basic Control System: Provide minimum of ____ hours of actual training on the control system itself. Upon completion of training, each attendee, using appropriate documentation, should be able to perform elementary operations and describe general hardware architecture and functionality of the system.
      a. This training may be held on-site or at the manufacturer's facility.
      b. If held off-site, the training may occur prior to final completion of the system installation.
      c. For off-site training, Contractor shall pay expenses of up to two attendees.
   2. Phase 2 - Integrating with HVAC Systems: Provide minimum of ____ hours of on-site, hands-on training after completion of Functional Testing. Include instruction on:
      a. The specific hardware configuration of installed systems in this facility and specific instruction for operating the installed system, including interfaces with other systems, if any.
      b. Security levels, alarms, system start-up, shut-down, power outage and restart routines, changing setpoints and alarms and other typical changed parameters, overrides, freeze protection, manual operation of equipment, optional control strategies that can be considered, energy savings strategies and set points that if changed will adversely affect energy consumption, energy accounting, procedures for obtaining vendor assistance, etc.
      c. Trend logging and monitoring features (values, change of state, totalization, etc.), including setting up, executing, downloading, viewing both tabular and graphically and printing trends; provide practice in setting up trend logging and monitoring during training session.
      d. Every display screen, allowing time for questions.
      e. Point database entry and modifications.
   3. Phase 3 - Post-Occupancy: Six months after occupancy conduct minimum of ____ hours of training. Tailor training session to questions and topics solicited beforehand from Owner. Also be prepared to address topics brought up and answer questions concerning operation of the system.

G. Provide the services of manufacturer representatives to assist instructors where necessary.

H. Provide the services of the HVAC controls instructor at other training sessions, when requested, to discuss the interaction of the controls system as it relates to the equipment being discussed.

END OF SECTION

SECTION 23 09 13

INSTRUMENTATION AND CONTROL DEVICES FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Air supply system.

B. Thermostats.

C. Control Panels.

D. Control Valves and Actuators.

E. Damper Operators.

F. Input/Output Sensors.

G. Transmitters.

H. Time clocks.

1.02 RELATED REQUIREMENTS

A. Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment.

B. Section 23 05 19 - Meters & Gages for HVAC Piping: Thermometer sockets, gage taps.

C. Section 23 21 13 - Hydronic Piping: Installation of control valves, flow switches, temperature sensor sockets, gage taps.

D. Section 23 33 00 - Air Duct Accessories: Installation of automatic dampers.

E. Section 23 09 23 - Direct-Digital Control System for HVAC.

F. Section 23 09 93 - Sequence of Operations for HVAC Controls.

G. Section 26 27 17 - Equipment Wiring: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. AMCA 500-D - Laboratory Methods for Testing Dampers for Rating; Air Movement and Control Association International, Inc.; 2012.

B. NEMA DC 3 - Residential Controls - Electrical Wall-Mounted Room Thermostats; National Electrical Manufacturers Association; 2013.

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); National Electrical Manufacturers Association; 2014.

D. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilation Systems; National Fire Protection Association; 2012.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide description and engineering data for each control system component. Include sizing as requested. Provide data for each system component and software module.

C. Shop Drawings: Indicate complete operating data, system drawings, wiring diagrams, and written detailed operational description of sequences. Submit schedule of valves indicating size, flow, and pressure drop for each valve. For automatic dampers indicate arrangement, velocities, and static pressure drops for each system.

D. Manufacturer's Instructions: Provide for all manufactured components.

E. Operation and Maintenance Data: Include inspection period, cleaning methods, recommended cleaning materials, and calibration tolerances.

F. Warranty: Submit manufacturers warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented commercial experience.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum five five years commerical experience and approved by manufacturer.

C. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.06 WARRANTY

A. See Section 01 77 00 - Contract Closeout, for additional warranty requirements.

B. Correct defective Work within a five year period after Substantial Completion.

PART 2 PRODUCTS

2.01 EXISTING COMPONENTS TO BE RE-USED

A. General: The existing chiller controls shall remain and shall be interfaced with the DDC system to implement chilled water supply temperature setpoint reset as specified in 23 09 93.

2.02 EQUIPMENT - GENERAL

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

2.03 AIR SUPPLY

2.04 CONTROL PANELS

A. Unitized cabinet type for each system under automatic control with relays and controls mounted in cabinet and temperature indicators, pressure gages, pilot lights, push buttons and switches flush on cabinet panel face.

B. NEMA 250, general purpose utility enclosures with enamelled finished face panel.

C. Provide common keying for all panels.

2.05 CONTROL VALVES AND ACTUATORS

A. Globe Pattern Valves:
   1. Over 2 inches: Iron body, bronze trim, stainless steel stem, bronze plug.
   2. Hydronic Systems:
      a. ANSI Class 125
      b. Linear flow characteristic for 3 way valves
      c. Suitable for chilled water service, 35% glycol
      d. Flanged connections
   3. Schedule: Air handler chilled water coil: 3-way, mixing, Cv=190.
   4. Acceptable product: Belimo G7, 4 inch nominal size.

B. Valve Actuators: Linear, non-spring return, brushless dc motor
   1. Application: Suitable for globe pattern valve supplied for chilled water flow control
   2. Signal: 2 to 10 vdc with feedback for position indication
   3. Electrical: 24 vac
   4. Acceptable product: Belimo EVB24-SR

2.06 DAMPERS

A. Performance: Test in accordance with AMCA 500-D.

B. Frames: Galvanized steel, welded or riveted with corner reinforcement, minimum 16 gage, 0.0635 inch.

C. Blades: Airfoil, Galvanized steel, maximum blade size 8 inches wide, 48 inches long, minimum 22 gage, 0.0299 inch, attached to minimum 1/2 inch shafts with set screws.

D. Blade Seals: Synthetic elastomeric inflatable mechanically attached, field replaceable.

E. Jamb Seals: Spring stainless steel.

F. Shaft Bearings: Oil impregnated sintered bronze.

G. Linkage Bearings: Oil impregnated sintered bronze.

H. Leakage: Class 1 or 1A

I. Maximum Pressure Differential: 6 inches wg.

J. Temperature Limits: -20 to 150 degrees F.

K. Acceptable Product: Air Balance AC516

2.07 DAMPER OPERATORS

A. General: Provide smooth proportional control with sufficient power for air velocities 20 percent greater than maximum design velocity and to provide tight seal against maximum system pressures. Provide spring return for two position control and for fail safe operation.
   1. Provide sufficient number of operators to achieve unrestricted movement throughout damper range.
   2. Provide one operator for maximum 36 sq ft damper section.

B. Electric Operators:
   1. Spring return, adjustable stroke motor having oil immersed gear train.
   2. Power supply: 24 VAC.
   3. Overload protection: Electronic throughout 0 to 95 degree rotation.
   4. Operating range: 2 to 10 VDC, 4 to 20 mA
   5. Torque: Minimum 133 in-lb
   6. Position indication: visual
   7. Manual override: hex crank.
   8. Running time: 150 seconds, spring return less than 20 seconds
   9. Product:
      a. Belimo AF24 series
      b. Substitutions: See Section 01 60 00 - Product Requirements.

2.08 INPUT/OUTPUT SENSORS

A. Temperature Sensors, 10k ohm thermistor
   1. Wall-mount sensors for occupied spaces
      a. LCD display.
      b. Local setpoint adjust.
      c. Hidden communication port.
      d. Occupancy override.
      e. ALC RS Pro, TAC, or approved.
   2. Duct-mount, probe type
      a. 4 inch to 18 inch probe length, depending on duct size
      b. 304 stainless steel probe
      c. Double encapsulated sensor
      d. Closed-cell foam to seal insertion hole.
      e. With steel J-box.
      f. BAPI, or approved.
   3. Duct-mount, averaging type
      a. Averaging length as required to suit duct size
      b. Bendable aluminum tubing
      c. With steel J-box.
      d. BAPI, or approved.
   4. Liquid immersion type
      a. 4 inch probe length
      b. 304 stainless steel probe
      c. Double encapsulated sensor

d. Closed-cell foam to seal insertion hole.
e. With steel J-box.
f. BAPI, or approved.
g. Thermowell: length to suit probe, one part machined brass

B. Wall-mount CO2 Sensors
1. Infra-red type
2. Maintenance-free
3. Measurement range: 0-2000 ppm
4. Display: LCD
5. Electrical: 24VAC/VDC
6. Manufacturer: SenseAir eSense D-II, or approved

C. Static Pressure Sensors:
1. Unidirectional with ranges not exceeding 150 percent of maximum expected input.
2. Temperature compensate with typical thermal error or 0.033% FS/degF in temperature range of 0 to 150F.
3. Accuracy: One percent of full scale with repeatability 0.3 percent.
4. Output: 0 - 5 vdc with power at 12 to 28 vdc.
5. Product: Setra Model 264, or equal.

D. Equipment Operation Sensors:
1. Status Inputs for Fans: Differential pressure switch with adjustable range of 0 to 5 inches wg.
2. Status Inputs for Pumps: Differential pressure switch piped across pump with adjustable pressure differential range of 8 to 60 psi.
3. Status Inputs for Electric Motors: Current sensing relay with current transformers, adjustable and set to 175 percent of rated motor current.

2.09 THERMOSTATS

A. Electric Room Thermostats:
1. Type: NEMA DC 3, 24 volts, with setback/setup temperature control.
2. Service: cooling and heating.
3. Covers: Locking with setpoint indication, with thermometer.

B. Room Thermostat Accessories:
1. Thermostat Covers: Brushed aluminum.
2. Thermostat Guards: Metal mounted on separate base.
3. Adjusting Key: As required for device.
4. Aspirating Boxes: Where indicated for thermostats requiring flush installation.

C. Outdoor Reset Thermostat:
1. Remote bulb or bimetal rod and tube type, proportioning action with adjustable throttling range, adjustable setpoint.
2. Scale range: -10 to 70 degrees F.

2.10 TIME CLOCKS

2.11 TRANSMITTERS

A. Building Static Pressure Transmitter:
1. One pipe, direct acting, double bell, scale range 0.01 to 6.0 inch wg positive or negative, and sensitivity of 0.0005 inch wg. Transmit electronic signal to receiver with matching scale range.

2.12 MISCELLANEOUS ACCESSORIES

A. Flow Switches. Flow-proving switches shall be differential pressure type (air or water service) as appropriate. Switches shall be UL listed, SPDT snap-acting, and pilot duty rated (125 VA minimum).
1. Differential pressure switches shall have scale range and differential suitable for intended application and NEMA 1 enclosure unless otherwise specified.

B. Relays.
   1. Control Relays. Control relays shall be plug-in type, UL listed, and shall have dust cover and LED "energized" indicator. Contact rating, configuration, and coil voltage shall be suitable for application.
   2. Time Delay Relays. Time delay relays shall be solid-state plug-in type, UL listed, and shall have adjustable time delay. Delay shall be adjustable ±100% from setpoint shown. Contact rating, configuration, and coil voltage shall be suitable for application. Provide NEMA 1 enclosure for relays not installed in local control panel.

C. Current Transmitters.
   1. AC current transmitters shall be self-powered, combination split-core current transformer type with built-in rectifier and high-gain servo amplifier with 4-20 mA two-wire output. Full-scale unit ranges shall be 10 A, 20 A, 50 A, 100 A, 150 A, and 200 A, with internal zero and span adjustment. Unit accuracy shall be ±1% full-scale at 500 ohm maximum burden.
   2. Transmitter shall meet or exceed ANSI/ISA S50.1 requirements and shall be UL/CSA recognized.
   3. Unit shall be split-core type for clamp-on installation on existing wiring.

D. Current Transformers.
   1. AC current transformers shall be UL/CSA recognized and shall be completely encased (except for terminals) in approved plastic material.
   2. Transformers shall be available in various current ratios and shall be selected for ±1% accuracy at 5 A full-scale output.
   3. Use fixed-core transformers for new wiring installation and split-core transformers for existing wiring installation.

E. Voltage Transmitters.
   1. AC voltage transmitters shall be self-powered single-loop (two-wire) type, 4-20 mA output with zero and span adjustment.
   2. Adjustable full-scale unit ranges shall be 100-130 Vac, 200-250 Vac, 250-330 Vac, and 400-600 Vac. Unit accuracy shall be ±1% full-scale at 500 ohm maximum burden.
   3. Transmitters shall meet or exceed ANSI/ISA S50.1 requirements and shall be UL/CSA recognized at 600 Vac rating.

F. Voltage Transformers.
   1. AC voltage transformers shall be UL/CSA recognized, 600 Vac rated, and shall have built-in fuse protection.
   2. Transformers shall be suitable for ambient temperatures of 4°C-55°C (40°F-130°F) and shall provide ±0.5% accuracy at 24 Vac and 5 VA load.
   3. Windings (except for terminals) shall be completely enclosed with metal or plastic.

G. Current Switches.
   1. Current-operated switches shall be self-powered, solid-state with adjustable trip current. Select switches to match application current and DDC system output requirements

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that systems are ready to receive work.

C. Beginning of installation means installer accepts existing conditions.

D. Sequence work to ensure installation of components is complementary to installation of similar components in other systems.

E. Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.

F. Ensure installation of components is complementary to installation of similar components.

G. Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions, and all applicable codes.

B. Mount outdoor reset thermostats and outdoor sensors indoors, with sensing elements outdoors with sun shield.

C. Install damper motors on outside of duct. Provide weather protective covering for outdoor installations.

D. Mount control panels adjacent to associated equipment on vibration free walls or free standing angle iron supports. One cabinet may accommodate more than one system in same equipment room. Provide engraved plastic nameplates for instruments and controls inside cabinet and engraved plastic nameplates on cabinet face.

E. Provide conduit and electrical wiring in accordance with Section 26 27 17. Electrical material and installation shall be in accordance with appropriate requirements of Division 26.

3.03 MAINTENANCE

A. See Section 01 70 00 - Execution Requirements, for additional requirements relating to maintenance service.

B. Provide a separate maintenance contract for specified maintenance service.

C. Provide service and maintenance of control system for one year from Date of Substantial Completion.

D. Provide complete service of controls systems, including call backs, and submit written report of each service call.

END OF SECTION

SECTION 23 09 23

DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. System Description
B. Operator Interface
C. Controllers
D. Control Panels
E. Input/Output Interface
F. Power Supplies and Line Filtering
G. Local Area Network
H. System Software
I. Controller Software
J. HVAC Control Programs

1.02 RELATED REQUIREMENTS

A. Section 28 31 00 - Fire Detection and Alarm.
B. Section 23 09 13 - Instrumentation and Control Devices for HVAC.
C. Section 23 09 93 - Sequence of Operations for HVAC Controls.
D. Section 26 27 17 - Equipment Wiring: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. ASHRAE Std 135 - BACnet - A Data Communication Protocol for Building Automation and Control Networks; 2012.
B. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide data for each system component and software module.
C. Shop Drawings:
    1. Indicate trunk cable schematic "riser diagram", showing programmable control unit locations, central panel and master control unit(s), and trunk data conductors.
    2. List connected data points, including connected control unit and input device.
    3. Sample system graphics indicating monitored systems, data point addresses (connected and calculated), and operator notations.
    4. Show system configuration including peripheral devices, batteries, AC fed power supplies,and point-to-point wiring diagrams.
    5. Sequence of Operation for all controller modules and connected equipment.
D. Manufacturer's Instructions: Indicate manufacturer's installation instructions for all manufactured components.
E. Project Record Documents: Record actual locations of control components, including control units, thermostats, and sensors.
    1. Revise shop drawings to reflect actual installation and Sequences of Operation. Identify all user adjustable values in Sequences of Operation at time of Substantial Completion.
    2. Include submittals data in final "Record Documents" form.
F. Operation and Maintenance Data:

1. Include interconnection wiring diagrams complete field installed systems with wired system components and devices, identified by unique number.
2. Include training manual with keyboard illustrations and step-by-step procedures indexed for each operator function.
3. Include inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.

G. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer(s) of all control equipment.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with NFPA 70.

B. Installer Qualifications: Company specializing in performing the work of this section with a minimum of years of commercial experience. Supervising field installer shall have a minimum of 5 years of commercial experience installing ddc systems, AND shall have obtained certificate of training in installation, startup, and troubleshooting for the products being installed

C. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.06 PRE-INSTALLATION MEETING

A. Convene one week before starting work of this Section.

B. Require attendance of parties directly affecting the work of this Section.

1.07 TRAINING

A. Contractor shall provide training to Owner and Owner’s representatives in two separate four hour classes.

B. Training Materials: Provide course outline and materials for each class at least six weeks before first class. Course outline shall address each Training goal or objective identified in Part 3 of this specification. Training shall be provided via instructor-led sessions, computer-based training, or web-based training. Engineer will modify course outlines and materials if necessary to meet Owner's needs. Engineer will review and approve course outlines and materials at least three weeks before first class.

1.08 DEMOLITION

A. Existing control system is entirely electro-pneumatic. Contractor shall be responsible for removal of all existing controls components including pneumatic tubing that will no longer be used. Contractor shall be responsible for review of all existing control documents including as-built drawings, and for field verification of existing conditions and equipment to be removed.

B. Where removal leaves open junction boxes or holes these shall be neatly covered or filled as appropriate. Where existing enclosures are in good locations and good condition, and are of adequate size, Contractor shall re-use enclosure. In locations exposed to view outside mechanical rooms, walls shall be painted to match surroundings

1.09 WARRANTY

A. See Section 01 77 00 - Contract Closeout, for additional warranty requirements

B. Provide five year manufacturer's warranty for field programmable micro-processor based units.

C. As part of warranty, provide service and maintenance of energy management and control systems for a minimum of one year from date of project Substantial Completion.

D. As part of warranty, provide four complete inspections, one in each season, to inspect, calibrate, and adjust controls as required, and submit written reports summarizing all observations and adjustments made.

1.10 OWNERSHIP OF PROPRIETARY MATERIAL

A. Project-specific software and documentation shall become Owner's property. This includes, but is not limited to:
1. Graphics

2. Record drawings
3. Database
4. Application programming code
5. Documentation

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. The following are the only approved DDC control system manufacturers, product lines, and suppliers accepted for this project:
   1. Automated Logic WebCTRL
      a. Supplier: Clima-Tech; Contact: Tim Snyder: 503-740-7918.

B. Substitutions: Substitutions shall not be allowed.

C. Use new products the manufacturer is currently manufacturing and selling for use in new installations. Do not use this installation as a product test site unless explicitly approved in writing by Owner. Spare parts shall be available for at least five years after completion of this contract.

D. The Contractor shall configure and install software provided under this Contract on Owner's existing OEM front-end platform, maintained on Owner's central servers. If an update is required to Owner's existing front-end platform to accommodate work of this Contract, Owner will perform this update using its own forces. [VERIFY WITH COUNTY]

E. Other products specified herein (such as sensors, actuators, relays, and switches) need not be manufactured by the above manufacturers

2.02 SYSTEM DESCRIPTION

A. A distributed and networked system of fully intelligent, stand-alone controllers, operating in a multi-tasking, multi-user environment on token-passing network, with central and remote hardware, software, and interconnecting wire and conduit.

B. Provide control systems consisting of temperature and humidity sensors, control valves, dampers, actuators, indicating devices, interface equipment and other apparatus and accessories required to operate mechanical systems, and to perform functions specified.

C. Controls for variable air volume terminals, radiation, reheat coils, unit heaters, fan coils, and the like when directly connected to the control units. Individual terminal unit control is specified in Section 23 09 13.

D. Include computer software and hardware, operator input/output devices, control units, local area networks (LAN), sensors, control devices, actuators.

E. User workstation access shall be browser-based, requiring only a username and password for system access.

F. Include installation and calibration, supervision, adjustments, and fine tuning necessary for complete and fully operational system.

2.03 OPERATOR INTERFACE

A. Workstation PC: Contractor shall provide micro-computer hardware for location on-site in existing server closet. Hardware shall represent top end of market capabilities at time of project installation and shall fully support all operator interface software and requirements including web enabled interface.

B. IP Address: Owner shall provide IP address for web access. Contractor shall work with Owner’s IT staff to create full web browser access functionality.

C. Workstation server software, controllers, and control backbone shall communicate using BACnet protocol and addressing.

D. BACnet/IP implementation to comply with ASHRAE Std 135 (most current version).

E. Minimum Capabilities:

1. An operator authentication system that requires an operator to log in before viewing or editing any data, and which can be configured to limit the privileges of an individual operator.
2. The ability to view and acknowledge any alarm in the system. Alarms or links to alarms shall be provided on a contiguous list so the operator can quickly view all alarms.
3. A summary page or pages for each piece of equipment in the system. This page shall include the current values of all critical I/O points and shall allow the operator to lock binary points on or off and to lock analog points to any value within their range.
4. Navigation links that allow the operator to quickly navigate from the home screen to any piece of equipment in the system, and then return to the home screen. These links may be arranged in a hierarchical fashion, such as navigating from the home screen to a particular building, then to a specific floor in the building, and then to a specific room or piece of equipment.
5. Operator Functions. Operator interface shall allow each authorized operator to execute the following functions as a minimum:
    a. Log In and Log Out. System shall require user name and password to log in to operator interface.
    b. Point-and-click Navigation. Operator interface shall be graphically based and shall allow operators to access graphics for equipment and geographic areas using point-and-click navigation.
    c. View and Adjust Equipment Properties. Operators shall be able to view controlled equipment status and to adjust operating parameters such as setpoints, PID gains, on and off controls, and sensor calibration.
    d. View and Adjust Operating Schedules. Operators shall be able to view scheduled operating hours of each schedulable piece of equipment on a weekly or monthly calendar-based graphical schedule display, to select and adjust each schedule and time period, and to simultaneously schedule related equipment. System shall clearly show exception schedules and holidays on the schedule display.
    e. View and Respond to Alarms. Operators shall be able to view a list of currently active system alarms, to acknowledge each alarm, and to clear (delete) unneeded alarms.
    f. View and Configure Trends. Operators shall be able to view a trend graph of each trended point and to edit graph configuration to display a specific time period or data range. Operator shall be able to create custom trend graphs to display on the same page data from multiple trended points.
    g. View and Configure Reports. Operators shall be able to run preconfigured reports, to view report results, and to customize report configuration to show data of interest.
    h. Manage Control System Hardware. Operators shall be able to view controller status, to restart (reboot) each controller, and to download new control software to each controller.
6. System Graphics.
    a. Coordination and Review of Existing Operator Interface. Existing graphics screens shall be reviewed in detail by Contractor. New graphics screens shall include all information content currently displayed unless acknowledged as unnecessary by Owner or Engineer.
    b. New Operator Interface. Operator interface shall be graphically based and shall include at least one graphic per piece of equipment or occupied zone, graphics for each chilled water and hot water system, and graphics that summarize conditions on each floor of each building included in this contract.
        1) Functionality. Graphics shall allow operator to monitor system status, to view a summary of the most important data for each controlled zone or piece of equipment, to use point-and-click navigation between zones or equipment, and to edit setpoints and other specified parameters.
        2) Animation. Graphics shall be able to animate by displaying different image files for changed object status.
        3) Alarm Indication. Indicate areas or equipment in an alarm condition using color or other visual indicator.

4) Format. Graphics shall be saved in an industry-standard format such as BMP, JPEG, or GIF. Web-based system graphics shall be viewable on browsers compatible with World Wide Web Consortium browser standards. Web graphic format shall require no plug-in (such as HTML and JavaScript) or shall only require widely available no-cost plug-ins (such as Active-X and Macromedia Flash).

7. System Tools. System shall provide the following functionality to authorized operators as an integral part of the operator interface or as stand-alone software programs. If furnished as part of the interface, the tool shall be available from each workstation or web browser interface. If furnished as a stand-alone program, software shall be installable on standard IBM-compatible PCs with no limit on the number of copies that can be installed under the system license.
   a. Automatic System Database Configuration. Each workstation or web server shall store on its hard disk a copy of the current system database, including controller firmware and software. Stored database shall be automatically updated with each system configuration or controller firmware or software change.
   b. Controller Memory Download. Operators shall be able to download memory from the system database to each controller.
   c. System Configuration. Operators shall be able to configure the system.
   d. Online Help. Context-sensitive online help for each tool shall assist operators in operating and editing the system.
   e. Security. System shall require a user name and password to view, edit, add, or delete data.
      1) Operator Access. Each user name and password combination shall define accessible viewing, editing, adding, and deleting functions in each system application, editor, and object. Authorized operators shall be able to vary and deny each operator's accessible functions based on equipment or geographic location.
      2) Automatic Log Out. Automatically log out each operator if no keyboard or mouse activity is detected. Operators shall be able to adjust automatic log out delay.
      3) Encrypted Security Data. Store system security data including operator passwords in an encrypted format. System shall not display operator passwords.
   f. System Diagnostics. System shall automatically monitor controller and I/O point operation. System shall annunciate controller failure and I/O point locking (manual overriding to a fixed value).
   g. Alarm Processing. System input and status objects shall be configurable to alarm on departing from and on returning to normal state. Operator shall be able to enable or disable each alarm and to configure alarm limits, alarm limit differentials, alarm states, and alarm reactions for each system object. Configure and enable alarm points as specified in Sequence of Operation. Alarms shall be BACnet alarm objects and shall use BACnet alarm services.
   h. Alarm Messages. Alarm messages shall use an English language descriptor without acronyms or mnemonics to describe alarm source, location, and nature.
   i. Alarm Reactions. Operator shall be able to configure (by object) actions workstation or web server shall initiate on receipt of each alarm. As a minimum, workstation or web server shall be able to log, print, start programs, display messages, send e-mail, send page, and audibly annunciate.
   j. Alarm Maintenance. Operators shall be able to view system alarms and changes of state chronologically, to acknowledge and delete alarms, and to archive closed alarms to the workstation or web server hard disk from each workstation or web browser interface.
   k. Trend Configuration. Operator shall be able to configure trend sample or change of value (COV) interval, start time, and stop time for each system data object and shall be able to retrieve data for use in spreadsheets and standard database programs. Controller shall sample and store trend data and shall be able to archive data to the

hard disk. Configure trends as specified in Sequence of Operation. Trends shall be BACnet trend objects.

l. Object and Property Status and Control. Operator shall be able to view, and to edit if applicable, the status of each system object and property by menu, on graphics, or through custom programs.

m. Reports and Logs. Operator shall be able to select, to modify, to create, and to print reports and logs. Operator shall be able to store report data in a format accessible by standard spreadsheet and word processing programs.

n. Standard Reports. Furnish the following standard system reports:
   1) Objects. System objects and current values filtered by object type, by status (in alarm, locked, normal), by equipment, by geographic location, or by combination of filter criteria.
   2) Alarm Summary. Current alarms and closed alarms. System shall retain closed alarms for an adjustable period.
   3) Logs. System shall log the following to a database or text file and shall retain data for an adjustable period:
      (a) Alarm History.
      (b) Trend Data. Operator shall be able to select trends to be logged.
      (c) Operator Activity. At a minimum, system shall log operator log in and log out, control parameter changes, schedule changes, and alarm acknowledgment and deletion. System shall date and time stamp logged activity.

o. Custom Reports. Operator shall be able to create custom reports that retrieve data, including archived trend data, from the system, that analyze data using common algebraic calculations, and that present results in tabular or graphical format. Reports shall be launched from the operator interface.

p. Graphics Generation. Graphically based tools and documentation shall allow Operator to edit system graphics, to create graphics, and to integrate graphics into the system. Operator shall be able to add analog and binary values, dynamic text, static text, and animation files to a background graphic using a mouse.

q. Graphics Library. Complete library of standard HVAC equipment graphics shall include equipment such as chillers, boilers, air handlers, terminals, fan coils, and unit ventilators. Library shall include standard symbols for other equipment including fans, pumps, coils, valves, piping, dampers, and ductwork. Library graphic file format shall be compatible with graphics generation tools.

r. Custom Application Programming. Operator shall be able to create, edit, debug, and download custom programs. System shall be fully operable while custom programs are edited, compiled, and downloaded. Programming language shall have the following features:
   1) Language. Language shall be graphically based or English language oriented. If graphically based, language shall use function blocks arranged in a logic diagram that clearly shows control logic flow. Function blocks shall directly provide functions listed below, and operators shall be able to create custom or compound function blocks. If English language oriented, language shall be based on the syntax of BASIC, FORTRAN, C, or PASCAL, and shall allow for free-form programming that is not column-oriented or "fill-in-the-blanks."
   2) Programming Environment. Tool shall provide a full-screen, cursor-and-mouse-driven programming environment that incorporates word processing features such as cut and paste. Operators shall be able to insert, add, modify, and delete custom programming code, and to copy blocks of code to a file library for reuse in other control programs.
   3) Independent Program Modules. Operator shall be able to develop independently executing program modules that can disable, enable and exchange data with other program modules.
   4) Debugging and Simulation. Operator shall be able to step through the program observing intermediate values and results. Operator shall be able to adjust input

variables to simulate actual operating conditions. Operator shall be able to adjust each step's time increment to observe operation of delays, integrators, and other time-sensitive control logic. Debugger shall provide error messages for syntax and for execution errors.

5) Conditional Statements. Operator shall be able to program conditional logic using compound Boolean (AND, OR, and NOT) and relational (EQUAL, LESS THAN, GREATER THAN, NOT EQUAL) comparisons.
6) Mathematical Functions. Language shall support floating-point addition, subtraction, multiplication, division, and square root operations, as well as absolute value calculation and programmatic selection of minimum and maximum values from a list of values.
7) Variables: Operator shall be able to use variable values in program conditional statements and mathematical functions.
   (a) Time Variables. Operator shall be able to use predefined variables to represent time of day, day of the week, month of the year, and date. Other predefined variables or simple control logic shall provide elapsed time in seconds, minutes, hours, and days. Operator shall be able to start, stop, and reset elapsed time variables using the program language.
   (b) System Variables. Operator shall be able to use predefined variables to represent status and results of Controller Software and shall be able to enable, disable, and change setpoints of Controller Software as described in Controller Software section

2.04 CONTROLLERS

A. BUILDING CONTROLLERS

1. General:
   a. Manage global strategies by one or more, independent, standalone, microprocessor based controllers.
   b. Provide sufficient memory to support controller's operating system, database, and programming requirements.
   c. Share data between networked controllers.
   d. Controller operating system manages input and output communication signals allowing distributed controllers to share real and virtual object information and allowing for central monitoring and alarms.
   e. Utilize real-time clock for scheduling.
   f. Continuously check processor status and memory circuits for abnormal operation.
   g. Controller to assume predetermined failure mode and generate alarm notification upon detection of abnormal operation.
   h. Communication with other network devices to be based on assigned protocol.
2. Communication:
   a. Controller to reside on a BACnet network using ISO 8802-3 (ETHERNET) Data Link/Physical layer protocol.
   b. Perform routing when connected to a network of custom application and application specific controllers.
   c. Provide service communication port for connection to a portable operator's terminal or hand held device with compatible protocol.
3. Anticipated Environmental Ambient Conditions:
   a. Outdoors and/or in Wet Ambient Conditions:
      1) Mount within waterproof enclosures.
      2) Rated for operation at 0 to 150 degrees F..
   b. Conditioned Space:
      1) Mount within dustproof enclosures.
      2) Rated for operation at 32 to 120 degrees F.
4. Provisions for Serviceability:
   a. Diagnostic LEDs for power, communication, and processor.

b. Make all wiring connections to field removable, modular terminal strips, or to a termination card connected by a ribbon cable.

5. Memory: In the event of a power loss, maintain all BIOS and programming information for a minimum of 72 hours.
6. Power and Noise Immunity:
   a. Maintain operation at 90 to 110 percent of nominal voltage rating.
   b. Perform orderly shutdown below 80 percent of nominal voltage.
   c. Operation protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W. at 3 feet.

2.05 CONTROL PANELS

A. NEMA 1 general purpose utility enclosure, hinged door, key-lock latch, and removable subpanels. A single key shall be common to all field panels. Provide cabinets in standard gray enamel finish.

B. Cabinets shall be sized with sufficient space to provide for mounting of power supply, power conditioning, control modules, and other panel devices, with all wire inside the cabinet individually identified per control/interlock drawings, routed in 1.5" minimum width wiring tracks and/or tie-wrapped. Terminals for field connections shall be UL liste for 600 volt service.

C. Provide ON/OFF power switch with overcurrent protection for control power sources to each local panel

2.06 INPUT/OUTPUT INTERFACE

A. Hardwired inputs and outputs tie into the DDC system through building, custom application, or application specific controllers.

B. All Input/Output Points:
   1. Protect controller from damage resulting from any point short-circuiting or grounding and from voltage up to 24 volts of any duration.
   2. Provide universal type for building and custom application controllers where input or output is software designated as either binary or analog type with appropriate properties.

C. Binary Inputs:
   1. Allow monitoring of On/Off signals from remote devices.
   2. Provide wetting current of 12 mA minimum, compatible with commonly available control devices and protected against the effects of contact bounce and noise.
   3. Sense dry contact closure with power provided only by the controller.

D. Pulse Accumulation Input Objects: Conform to all requirements of binary input objects and accept up to 10 pulses per second.

E. Analog Inputs:
   1. Allow for monitoring of low voltage 0 to 10 VDC, 4 to 20 mA current, or resistance signals (thermistor, RTD).
   2. Compatible with and field configurable to commonly available sensing devices.

F. Binary Outputs:
   1. Used for On/Off operation or a pulsed low-voltage signal for pulse width modulation control.
   2. Outputs provided with three position (On/Off/Auto) override switches.
   3. Status lights for building and custom application controllers to be selectable for normally open or normally closed operation.

G. Analog Outputs:
   1. Monitoring signal provides a 0 to 10 VDC or a 4 to 20 mA output signal for end device control.
   2. Provide status lights and two position (AUTO/MANUAL) switch for building and custom application controllers with manually adjustable potentiometer for manual override on building and custom application controllers.
   3. Drift to not exceed 0.4 percent of range per year.

H. System Object Capacity:
   1. System size to be expandable to twice the number of input output objects required by providing additional controllers, including associated devices and wiring.
   2. Hardware additions or software revisions for the installed operator interfaces are not to be required for future, system expansions.

2.07 POWER SUPPLIES AND LINE FILTERING

A. Power Supplies:
   1. Provide UL listed control transformers with Class 2 current limiting type or over-current protection in both primary and secondary circuits for Class 2 service as required by the NEC.
   2. Limit connected loads to 80 percent of rated capacity.
   3. Match DC power supply to current output and voltage requirements.
   4. Unit to be full wave rectifier type with output ripple of 5.0 mV maximum peak to peak.
   5. Provide over-voltage and over-current protection to withstand a 150 percent current overload for 3 seconds minimum without trip-out or failure.
   6. Operational Ambient Conditions: 32 to 120 degrees F.
   7. Line voltage units UL recognized and CSA approved.

B. Power Line Filtering:
   1. Provide external or internal transient voltage and surge suppression component for all workstations and controllers.
   2. Minimum surge protection attributes:
      a. Dielectric strength of 1000 volts minimum.
      b. Response time of 10 nanoseconds or less.
      c. Transverse mode noise attenuation of 65 dB or greater.
      d. Common mode noise attenuation of 150 dB or greater at 40 to 100 Hz.

2.08 LOCAL AREA NETWORK (LAN)

A. Provide communication between control units over local area network (LAN).

B. LAN Capacity: Not less than 60 stations or nodes.

C. Break in Communication Path: Alarm and automatically initiate LAN reconfiguration.

D. LAN Data Speed: Minimum 19.2 Kb.

E. Communication Techniques: Allow interface into network by multiple operation stations and by auto-answer/auto-dial modems. Support communication over telephone lines utilizing modems.

F. Transmission Median: Fiber optic or single pair of solid 24 gauge twisted, shielded copper cable.

G. Network Support: Time for global point to be received by any station, shall be less than 3 seconds. Provide automatic reconfiguration if any station is added or lost. If transmission cable is cut, reconfigure two sections with no disruption to system's operation, without operator intervention.

2.09 CONTROLLER SOFTWARE

A. All applications reside and operate in the system controllers and editing of all applications occurs at the operator workstation.

B. System Security:
   1. User access secured via user passwords and user names.
   2. Passwords restrict user to the objects, applications, and system functions as assigned by the system manager.
   3. User Log On/Log Off attempts are recorded.
   4. Automatic Log Off occurs following the last keystroke after a user defined delay time.

C. Object or Object Group Scheduling:
   1. Weekly Schedules Based on Separate, Daily Schedules:
      a. Include start, stop, optimal stop, and night economizer.

b. 10 events maximum per schedule.
c. Start/stop times adjustable for each group object.

2. Exception Schedules:
   a. Based on any day of the year.
   b. Defined up to one year in advance.
   c. Automatically discarded and replaced with standard schedule for that day of the week upon execution.
3. Holiday or Special Schedules:
   a. Capability to define up to 99 schedules.
   b. Repeated annually.
   c. Length of each period is operator defined.

D. Provide standard application for equipment coordination and grouping based on function and location to be used for scheduling and other applications.

E. Alarms:
1. Binary object is set to alarm based on the operator specified state.
2. Analog object to have high/low alarm limits.
3. All alarming is capable of being automatically and manually disabled.
4. Alarm Reporting:
   a. Operator determines action to be taken for alarm event.
   b. Alarms routing options available to users shall include workstations, telecommunication devices such as cell phones or tablets, and central alarm console.

F. Maintenance Management: System monitors equipment status and generates maintenance messages based upon user-designated run-time limits.

G. Sequencing: Application software shall implement the approved detailed sequences of operation submitted by Contractor, meeting all functional requirements set forth in the Control Narrative on the drawings

H. PID Control Characteristics:
1. Direct or reverse action.
2. Anti-windup.
3. Calculated, time-varying, analog value, positions an output or stages a series of outputs.
4. User selectable controlled variable, set-point, and PED gains.

I. Staggered Start Application:
1. Prevents all controlled equipment from simultaneously restarting after power outage.
2. Order of equipment startup is user selectable.

J. Energy Calculations:
1. Accumulated instantaneous power or flow rates are converted to energy use data.
2. Algorithm calculates a rolling average and allows window of time to be user specified in minute intervals.
3. Algorithm calculates a fixed window average with a digital input signal from a utility meter defining the start of the window period that in turn synchronizes the fixed-window average with that used by the power company.

K. Anti-Short Cycling:
1. All binary output objects protected from short-cycling.
2. Allows minimum on-time and off-time to be selected.

L. On-Off Control with Differential:
1. Algorithm allows binary output to be cycled based on a controlled variable and set-point.
2. Algorithm to be direct-acting or reverse-acting incorporating an adjustable differential.

M. Run-Time Totalization:
1. Totalize run-times for all binary input objects.
2. Provides operator with capability to assign high run-time alarm.

2.10 HVAC CONTROL PROGRAMS

A. General:
   1. Support Inch-pounds and SI (metric) units of measurement.
   2. Identify each HVAC Control system.

B. Control Sequences:
   1. Application programs shall sequence all mechanical equipment as indicated in Sequence of Operation (Part 3 of Section 23 09 93).

2.11 WIRING AND RACEWAYS

A. General. Provide copper wiring, plenum cable, and raceways as specified in applicable sections of Division 26.

B. Insulated wire shall use copper conductors and shall be UL listed for 90°C (200°F) minimum service.

PART 3 EXECUTION

3.01 EXAMINATION

A. Thoroughly examine project plans and existing conditions for control device and equipment locations. Report discrepancies, conflicts, or omissions to Engineer for resolution before starting rough-in work.

B. Verify that conditioned power supply is available to the control units and to the operator work station. Verify that field end devices and wiring is installed prior to installation proceeding.

C. Examine drawings and specifications for work of others. Report potential conflict or other discrepancies to Engineer and obtain written instructions for changes necessary to accommodate controls work as specified.

3.02 INSTALLATION

A. Install control units and other hardware in position on permanent walls where not subject to excessive vibration.

B. Install software in control units and in operator work station. Implement all features of programs to specified requirements and appropriate to sequence of operation. Refer to Section 23 09 93.

C. Provide conduit and electrical wiring in accordance with Section 26 27 17. Electrical material and installation shall be in accordance with appropriate requirements of Division 26.

3.03 COORDINATION

A. Site.
   1. Assist in coordinating space conditions to accommodate other work in the same area.
   2. Coordinate and schedule work with other work in the same area and with work dependent upon other work to facilitate mutual progress.

B. Test and Balance.
   1. Provide Test and Balance Contractor a single set of necessary tools to interface to control system for testing and balancing.
   2. Train Test and Balance Contractor to use control system interface tools.

C. Coordination with Other Controls. Integrate with and coordinate controls and control devices furnished or installed in other sections or existing to be re-used.
   1. Each controls product shall be configured, programmed, started up, and tested to meet the Sequence of Operation.
   2. Coordinate and resolve incompatibility issues that arise between control products provided under this section, those provided under other sections or divisions of this specification, and those existing that shall be re-used.
   3. Integrate control products provided by multiple suppliers.

3.04 WIRING

A. Control and interlock wiring and installation shall comply with national and local electrical codes, Division 26, and manufacturer's recommendations. Where the requirements of Section 230923 differ from Division 26, Section 230923 shall take precedence.

B. NEC Class 1 (line voltage) wiring shall be UL listed in approved raceway as specified by NEC and Division 16.

C. Low-voltage wiring shall meet NEC Class 2 requirements. Subfuse low-voltage power circuits as required to meet Class 2 current limit.

D. NEC Class 2 (current-limited) wires not in raceway but in concealed and accessible locations such as return air plenums shall be UL listed for the intended application.

E. Install wiring in raceway where subject to mechanical damage and at levels below 3 m (10ft) in mechanical, electrical, or service rooms.

F. Install Class 1 and Class 2 wiring in separate raceways. Boxes and panels containing high-voltage wiring and equipment shall not be used for low-voltage wiring except for the purpose of interfacing the two through relays and transformers.

G. Do not install wiring in raceway containing tubing.

H. Run exposed Class 2 wiring parallel to a surface or perpendicular to it and tie neatly at 3 m (10 ft) intervals.

I. Use structural members to support or anchor plenum cables without raceway. Do not use ductwork, electrical raceways, piping, or ceiling suspension systems to support or anchor cables.

J. Secure raceways with raceway clamps fastened to structure and spaced according to code requirements. Raceways and pull boxes shall not be hung on or attached to ductwork, electrical raceways, piping, or ceiling suspension systems.

K. Size raceway and select wire size and type in accordance with manufacturer's recommendations and NEC requirements.

L. Include one pull string in each raceway 2.5 cm (1 in.) or larger.

M. Use color-coded conductors throughout.

N. Locate control and status relays in designated enclosures only. Do not install control and status relays in packaged equipment control panel enclosures containing Class 1 starters.

O. Conceal raceways except within mechanical, electrical, or service rooms. Maintain minimum clearance of 15 cm (6 in.) between raceway and high-temperature equipment such as steam pipes or flues.

P. Adhere to requirements in Division 16 where raceway crosses building expansion joints.

Q. Install insulated bushings on raceway ends and enclosure openings. Seal top ends of vertical raceways.

R. Terminate control and interlock wiring related to the work of this section. Maintain at the job site updated (as-built) wiring diagrams that identify terminations.

S. Flexible metal raceways and liquid-tight flexible metal raceways shall not exceed 1 m (3 ft) in length and shall be supported at each end. Do not use flexible metal raceway less than ½ in. electrical trade size. Use liquid-tight flexible metal raceways in areas exposed to moisture including chiller and boiler rooms.

T. Install raceway rigidly, support adequately, ream at both ends, and leave clean and free of obstructions. Join raceway sections with couplings and according to code. Make terminations in boxes with fittings. Make terminations not in boxes with bushings.

3.05 COMMUNICATION WIRING

A. Communication wiring shall be low-voltage Class 2 wiring and shall comply with Article 3.6 (Wiring).

B. Install communication wiring in separate raceways and enclosures from other Class 2 wiring.

C. During installation do not exceed maximum cable pulling, tension, or bend radius specified by the cable manufacturer.

D. Verify entire network's integrity following cable installation using appropriate tests for each cable.

E. Install lightning arrestor according to manufacturer's recommendations between cable and ground where a cable enters or exits a building.

F. Each run of communication wiring shall be a continuous length without splices when that length is commercially available. Runs longer than commercially available lengths shall have as few splices as possible using commercially available lengths.

G. Label communication wiring to indicate origination and destination.

H. Ground coaxial cable according to NEC regulations article on "Communications Circuits, Cable, and Protector Grounding."

3.06 PROGRAMMING

A. Point Naming. Name points to be consistent with the equipment points list provided in Section 23 09 13. Where multiple points with the same name reside in the same controller, each point name may be customized with its associated Program Object number. For example, "Zone Temp 1" for Zone 1, "Zone Temp 2" for Zone 2.

B. Software Programming. Programming shall provide actions for each possible situation. Graphic- or parameter-based programs shall be documented. Text-based programs shall be modular, structured, and commented to clearly describe each section of the program.
   1. Application Programming. Provide application programming that adheres to sequences of operation specified in Section 23 09 13. Program documentation or comment statements shall reflect language used in sequences of operation.
   2. System Programming. Provide system programming necessary for system operation.

C. Operator Interface.
   1. Standard Graphics. Provide graphics as specified in System Graphics, above. Show on each equipment graphic input and output points and relevant calculated points such as indicated on the applicable Points List in Sequence of Operation. Point information on graphics shall dynamically update.
   2. Install, initialize, start up, and troubleshoot operator interface software and functions (including operating system software, operator interface database, and third-party software installation and integration required for successful operator interface operation) as described in Section 230923.

3.07 CONTROL SYSTEM CHECKOUT AND TESTING

A. Startup Testing. Complete startup testing to verify operational control system before notifying Owner of system demonstration. Provide Owner with schedule for startup testing. Owner may have representative present during any or all startup testing.
   1. Calibrate and prepare for service each instrument, control, and accessory equipment furnished as part of this or other controls sections.
   2. Verify that control wiring is properly connected and free of shorts and ground faults. Verify that terminations are tight.
   3. Enable control systems and verify each input device's calibration. Calibrate each device according to manufacturer's recommendations.
   4. Verify that binary output devices such as relays, solenoid valves, two-position actuators and control valves, and magnetic starters, operate properly and that normal positions are correct.
   5. Verify that analog output devices such as I/Ps and actuators are functional, that start and span are correct, and that direction and normal positions are correct. Check control valves and automatic dampers to ensure proper action and closure. Make necessary adjustments to valve stem and damper blade travel.

6. Prepare a log documenting startup testing of each input and output device, with technician's initials certifying each device has been tested and calibrated.
7. Verify that system operates according to sequence of operation. Simulate and observe each operational mode by overriding and varying inputs and schedules. Tune PID loops and each control routine that requires tuning.
8. Verify that points are correctly mapped to both application programs and graphics screens.
9. Alarms and Interlocks.
    a. Check each alarm with an appropriate signal at a value that will trip the alarm.
    b. Trip interlocks using field contacts to check logic and to ensure that actuators fail in the proper direction.
    c. Test interlock actions by simulating alarm conditions to check initiating value of variable and interlock action.

3.08 CONTROL SYSTEM DEMONSTRATION AND ACCEPTANCE

A. Demonstration. Prior to acceptance, perform the following performance tests to demonstrate system operation and compliance with specification after and in addition to tests specified in Control System Checkout and Testing, above. Provide Engineer with log documenting completion of startup tests.
    1. Engineer will be present to observe and review system demonstration. Notify Engineer at least 10 days before system demonstration begins.
    2. Demonstration shall follow process submitted and approved under Submittals, above. Complete approved checklists and forms for each system as part of system demonstration.
    3. Demonstrate actual field operation of each sequence of operation. Provide at least two persons equipped with two-way communication. Demonstrate calibration and response of any input and output points requested by Engineer. Provide and operate test equipment required to prove proper system operation.
    4. Demonstrate compliance with sequences of operation through each operational mode.
    5. Demonstrate complete operation of operator interface.
    6. Demonstrate each of the following.
        a. DDC loop response. Supply graphical trend data output showing each DDC loop's response to a setpoint change representing an actuator position change of at least 25% of full range. Trend sampling rate shall be from 10 seconds to 3 minutes, depending on loop speed. Each sample's trend data shall show setpoint, actuator position, and controlled variable values. Engineer will require further tuning of each loop that displays unreasonably under- or over-damped control.
        b. Trend logs for each system. Trend data shall indicate setpoints, operating points, valve positions, and other data as specified in the points list provided with each sequence of operation. Each log shall cover three 48-hour periods and shall have a sample frequency not less than 10 minutes or as specified on its points list. Logs shall be accessible through system's operator interface and shall be retrievable for use in other software programs as specified in Trend Configuration, above.
    7. Tests that fail to demonstrate proper system operation shall be repeated after Contractor makes necessary repairs or revisions to hardware or software to successfully complete each test.

B. Acceptance.
    1. After tests described in this specification are performed to the satisfaction of both Engineer and Owner, Engineer will accept control system as meeting completion requirements. Engineer may exempt tests from completion requirements that cannot be performed due to circumstances beyond Contractor's control. Engineer will provide written statement of each exempted test. Exempted tests shall be performed as part of warranty.
    2. System shall not be accepted until completed demonstration forms and checklists are submitted and approved as required in Submittals, above

3.09 CLEANING

A. Each day clean up debris resulting from work. Remove packaging material as soon as its contents have been removed. Collect waste and place in designated location.

B. On completion of work in each area, clean work debris and equipment. Keep areas free from dust, dirt, and debris.

C. On completion of work, check equipment furnished under this section for paint damage. Repair damaged factory-finished paint to match adjacent areas. Replace deformed cabinets and enclosures with new material and repaint to match adjacent areas.

3.10 TRAINING

A. Provide training for a designated staff of Owner's representatives. Training shall be provided via self-paced training, web-based or computer-based training, classroom training, or a combination of training methods. Provide a total of 16 hours of directed training, either in class or by telephone. At least 8 hours of training shall be in class, presented in two separate classes.

B. Training shall enable students to accomplish the following objectives.
   1. Proficiently operate system
   2. Understand control system architecture and configuration
   3. Understand DDC system components
   4. Understand system operation, including DDC system control and optimizing routines (algorithms)
   5. Operate workstation and peripherals
   6. Log on and off system
   7. Access graphics, point reports, and logs
   8. Adjust and change system setpoints, time schedules, and holiday schedules
   9. Recognize common HVAC system malfunctions by observing system graphics, trend graphs, and other system tools
   10. Understand system drawings and Operation and Maintenance manual
   11. Understand job layout and location of control components
   12. Access data from DDC controllers
   13. Operate portable operator's terminals
   14. Create and change system graphics
   15. Create, delete, and modify alarms, including configuring alarm reactions
   16. Create, delete, and modify point trend logs (graphs) and multi-point trend graphs
   17. Configure and run reports
   18. Add new users and understand password security procedures

C. Provide course outline and materials according to Section 230923 Article 1.07. Provide one copy of training material per student.

D. Instructors shall be factory-trained and experienced in presenting this material.

E. Perform classroom training using a network of working controllers representative of installed hardware.

END OF SECTION

SECTION 23 09 93

SEQUENCE OF OPERATIONS FOR HVAC CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This section defines the manner and method by which controls function. Requirements for each type of control system operation are specified. Equipment, devices, and system components required for control systems are specified in other sections.

B. For this project, an existing, outdated pneumatic system is being replaced with the current generation DDC system, with the goal of reducing energy use. Most of the existing control sequences, as understood from published documents are to be retained in concept. Refinements to those sequences are added, and the overall new sequences to be implemented are defined in this Section.

1.02 RELATED SECTIONS

A. Section 01 91 13 - General Commissioning Requirements:

B. Section 23 09 23 - Direct-Digital Control System for HVAC.

C. Section 23 09 13 - Instrumentation and Control Devices for HVAC.

1.03 SYSTEM DESCRIPTION

A. This Section defines the manner and method by which controls function. Requirements for each type of control system operation are specified. Equipment, devices, and system components required for control systems are specified in other Sections.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Sequence of Operation Documentation: Submit written sequence of operation for entire HVAC system and each piece of equipment.
   1. Preface: 1 or 2 paragraph overview narrative of the system describing its purpose, components and function.
   2. State each sequence in small descriptive and uniquely identified segments; provide a complete description regardless of the completeness and clarity of the sequences specified in the contract documents.
   3. Provide sequences for all applicable operating modes, including at least the following:
      a. Start-up.
      b. Warm-up mode.
      c. Normal operating mode.
      d. Unoccupied mode.
      e. Shutdown.
      f. Capacity control sequences and equipment staging.
      g. Temperature and pressure control, such as setbacks, setups, resets, etc.
      h. Detailed sequences for all control strategies, such as economizer control, optimum start/stop, staging, optimization, demand limiting, etc.
      i. Effects of power or equipment failure with all standby component functions.
      j. Sequences for all alarms and emergency shut downs.
      k. Interactions and interlocks with other systems.
   4. Include initial and recommended values for all adjustable settings, setpoints and parameters that are typically set or adjusted by operating staff; and any other control settings or fixed values, delays, etc. that will be useful during testing and operating the equipment.

C. Points List: Submit list of all control points indicating at least the following for each point. Points list shall be complete to achieve full functionality of the Sequence of Operations as specified in Part 3. Minimum number of points list shall include those listed in Part 4 of this specification section.

1. Name of controlled system.
2. Point abbreviation.
3. Point description; such as dry bulb temperature, airflow, etc.
4. Display units.
5. Indicate Point Type:
    a. Control point or setpoint (Yes / No); i.e. a point that controls equipment and can have its setpoint changed.
    b. Monitoring point (Yes / No); i.e. a point that does not control or contribute to the control of equipment but is used for operation, maintenance, or performance verification.
    c. Intermediate point (Yes / No); i.e. a point whose value is used to make a calculation which then controls equipment, such as space temperatures that are averaged to a virtual point to control reset.
    d. Calculated point (Yes / No); i.e. a "virtual" point generated from calculations of other point values.

D. Project Record Documents: Record actual locations of components and setpoints of controls, including changes to sequences made after submission of shop drawings.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 BUILDING VARIABLE AIR VOLUME (VAV) SYSTEM

A. General: A single large VAV system serves most of the building and provided heating, cooling, and ventilation. Controlled equipment within the system includes the following:
1. AHU-1: Built up air handling unit in 1st floor mixed air plenum fan room.
2. REF-04A/B: Two (2) Relief fans on roof.
3. EF-x: Four (4) small roof exhaust fans.
4. TU-x: Sixty-three (63) VAV terminal units with electric reheat.
5. TU-y: One (1) CV terminal unit with electric reheat.

B. Automatic Temperature Control: Automatic temperature control will be implemented on time schedule (adj.) via central DDC. Schedule shall be initially set up as follows.
1. Occupied start time: Fan shall operate continuously during the occupied period. Start time will be determined by optimal start algorithm to achieve occupied period setpoints (adjustable at central control interface) by the beginning of the occupied period (adj.)
    a. Beginning of occupied period: 7:00 AM, Monday through Friday.
    b. Occupied period setpoints: 74 deg. F (cooling); 70 deg. F (heating)
2. Occupied stop time: Occupied period shall end by schedule (adj.), initially set at 6:00 PM, Monday through Friday.
3. Morning warm-up or cool-down operation: Upon start by optimal start algorithm, AHU-1 shall operate in warm-up or cool-down mode to achieve setpoints as required by optimal start. Mode shall be determined by polling of zones. If average temperature is less than occupied period heating setpoint, warm-up mode shall be initiated. If average zone temperature is greater than occupied period setpoint, then cool-down mode shall be initiated. Once average zone temperature is within the occupied period temperature deadband, system shall transitions to occupied period operation.
    a. Warm-up mode:
        1) AHU-1 fan capacity control shall operate in occupied period mode.
        2) Outside air and relief air dampers shall be positioned to full closed.
        3) Chilled water valve shall be positioned to full bypass.
        4) Relief fan REF-04 shall remain de-energized.
        5) Small exhaust fans shall remain de-energized.
        6) Terminal unit dampers and reheat controls shall operate in occupied period mode.
    b. Cool-down mode:
        1) AHU-1 fan capacity control shall operate in occupied period mode.

2) AHU-1 supply air temperature control shall operate in occupied period mode.
3) Outside air and relief air dampers shall operate in economizer mode.
4) Relief fan REF-04 shall operate in occupied period mode.
5) Small exhaust fans shall remain de-energized.
6) Terminal unit dampers and reheat controls shall operate in occupied period mode.

4. Occupied period operation:
   a. Supply air temperature control: Supply air temperature setpoint shall be reset incrementally based on polling of terminal unit (TU) cooling loop output signals. Economizer dampers shall be modulated as a priority control response to maintain supply air temperature setpoint. Chilled water valve shall be modulated to supplement economizer performance to maintain supply air temperature setpoint. Reset parameters and terminal unit polling population shall be adjustable. Initial setpoints are defined below.
      1) TUs to be polled: 100% of VAV terminal units.
      2) Minimum supply air temperature (SAT) setpoint: 55 deg. F
      3) Maximum SAT setpoint: 65 deg. F
      4) Cooling loop output low limit: 90%
      5) No. of TUs exceeding low limit: 3
      6) Polling time interval: 5 minutes
      7) Reset increment: 1 deg. F
   b. Supply fan capacity / duct static pressure control: Duct static pressure setpoint shall be reset incrementally based on polling of terminal unit (TU) damper signals. Supply fan speed shall be modulated via VFD to maintain duct pressure setpoint. Reset parameters and terminal unit polling population shall be adjustable. Duct static pressure sensors shall be installed in each of the five zone ducts (locations shown in drawings). The lowest of the five pressure measurements shall be used as the control variable. Initial setpoints are defined below.
      1) TUs to be polled: 100% of VAV terminal units.
      2) Maximum duct pressure setpoint (DSP) setpoint: 1.5 inches wc.
      3) Minimum DSP setpoint: 0.7 inches wc.
      4) TU damper signal high limit: 100% open
      5) No. of dampers at high limit: 1
      6) Polling time interval: 5 minutes
      7) Reset increment: 0.1 inches wc
   c. Outside air and relief air damper operation: In occupied mode, outside air dampers and relief air dampers shall operate in minimum ventilation mode or economizer mode, as defined below.
      1) Minimum ventilation mode: When outside air temperature is above economizer high limit setpoint, mixed air damper control shall be in minimum ventilation mode. Minimum outside air damper sections (lower section of each damper set) shall be fully open. Relief dampers (at suction of REF-04) shall be fully open.
      2) Economizer mode: When OSA temperatures are at or below economizer high limit setpoint (adj.), economizer outside air dampers shall be modulated (in addition to minimum outside air dampers) to maintain mixed air setpoint. Mixed air setpoint shall be established at the supply air temperature setpoint minus fan heat temperature offset (adj.). Initial setpoints shall be as follows.
         (a) Economizer high limit: 72 deg. F.
         (b) Fan heat offset: 2.3 deg. F.
   d. Building pressure and relief fan (REF-04) speed control: Building differential pressure shall be monitored at two locations (shown on drawings). Relief fan speed shall be modulated to maintain the differential pressure setpoint at the sensor with the lowest reading. Setpoint shall be adjustable and shall be initially programmed as follows:
      1) Building pressure setpoint: positive 0.02 inches wc.

e. Zone temperature control: Zone temperature control shall maintain space temperature sepoints in VAV applications by first modulating TU dampers (from cooling maximum setpoint to cooling minimum setpoint). On an initial call for heat, damper shall position to heating minimum setpoint and electric reheat coil capacity shall be modulated via SCR control to satisfy space temperature setpoint. On continued call for heat, TU damper shall modulate open along with reheat coil capacity modulation to maintain TU discharge air temperature at scheduled leaving air temperature..

f. Exhaust fan interlocks: Four exhaust fans serve various areas within the zones served by AHU-1. Exhaust fan control sequences are listed below.
   1) EF-03A: 3rd floor breakroom exhaust fan, EF-03A, shall operate during occupied period operation of AHU-1.
   2) EF-03B: General restroom exhaust fan, EF-03B, shall operate during occupied period operation of AHU-1.
   3) EF-04A: TB room (AIIR) exhaust fan, EF-04A, shall be interlocked with the constant volume TU serving the AIIR, or as manually overridden at fan override interval timer switch.
   4) EF-04: Clinic and family planning area restroom exhaust fan, EF-04, shall operate during occupied period operation of AHU-1.

5. Unoccupied period operation: All other hours outside of occupied period schedule and warm-up or cool-down operation shall be designated as unoccupied period.
   a. System enable/disable: AHU-1, REF-04, EF-03A, EF-03B, EF-04A, and EF-04 shall be de-energized during unoccupied period unless one of the following conditions occurs.
      1) One or more zone temperatures drops below unoccupied period low limit.
      2) One or more zone temperatures rises above unoccupied period high limit.
      3) Temporary override operation is initiated by occupants.
   b. Setpoints: Unoccupied period setpoints shall be adjustable at central control interface, and shall initially be programmed as follows:
      1) Low limit space temperature: 60 deg. F
      2) High limit space temperature: 85 deg. F
      3) Occupant-initiated override period duration: 1 hour
   c. Operation:
      1) Low limit override: Upon enable and operation on low limit override, system shall operate in occupied period mode until space temperature in zone initiating override is at least 5 deg. F (adj.) above low limit setpoint. The following addition operating parameters shall be in place.
         (a) OSA and relief air dampers shall be fully closed.
         (b) REF-04 shall remain de-energized.
         (c) Exhaust fans EF-03A, Ef-03B, EF-04A, and EF-04 shall remain de-energized.
         (d) Chilled water valve: Full bypass.
         (e) Duct static pressure setpoint: Minimum setpoint in the occupied period reset schedule.
      2) High limit override: Upon enable and operation on high limit override, system shall operate in occupied period mode until space temperature in zone initiating override is at least 5 deg. F (adj.) below high limit setpoint. The following additional operating parameters shall be in place.
         (a) Outside air dampers and relief air dampers: Operate in economizer mode, subject to economizer high limit setpoint. If economizer mode is disabled, position OSA dampers and relief dampers to fully closed position, and de-energize REF-04.
         (b) Exhaust fans EF-03A, Ef-03B, EF-04A, and EF-04 shall remain de-energized.
         (c) Chilled water valve: Modulate to maintain supply air temperature setpoint.

(d) Duct static pressure setpoint: Minimum setpoint in the occupied period reset schedule.

3) Occupant-initiated override: Occupant override can be initiated via override buttons located at zone temperature sensors. Upon occupant-initiated override, system shall operate in occupied period operation for a period of time equal to the override period duration.

6. Safeties and Alarms: This section defines minimum required sequences for safeties and alarming functions via the DDC system.
   a. Smoke detection: [insert sequence]
   b. Duct high pressure: [insert sequence]
   c. Freeze protection: [insert sequence]
   d. VFD fault: [insert sequence]

3.02 SINGLE ZONE COOLING UNITS

A. General: Three dedicated single zone air-conditioning units are currently installed in the building. The units are as indicated below and are equipped with existing programmable thermostats. Temperature control shall remain as exists for these units. ZONE TEMPERATURE ALARMING FUNCTIONALITY ONLY SHALL BE IMPLEMENTED AS PART OF THE DDC SYSTEM.
   1. HP-2-ACU-01: Split system cooling unit for server room (Room 2244).
   2. HP-PAC-01: Portable air condition unit for server room (Room 2244).
   3. HP-2-ACU-02: Split system cooling unit for telecom room (Room 1284).

B. Alarms: Temperature alarm shall be generated if high limit setpoints (adj.) are exceeded for the following rooms.
   1. Room 1284 (Telecom): High temperature limit: 80 deg. F
   2. Room 2244 (Server): High temperature limit: 80 deg. F

3.03 CHILLED WATER SYSTEM

A. General: A 125 ton air-cooled rotary screw chiller (Trane R-series) was installed in 2008 to replace the original chiller/cooling tower installation. Two new chilled water pumps will be installed as part of this project. Control sequences to be implemented by DDC include enable/disable, pump lead/lag designation, and chilled water temperature setpoint reset. All other controls shall remain as exist, external of the new DDC system. Specific information about the controlled plant equipment is listed below.
   1. Existing chiller: Trane RHAA-125
   2. CHWP-1A: 300 gpm, 30 feet, 5 hp, constant speed
   3. CHWP-1B: 300 gpm, 30 feet, 5 hp, constant speed

B. Chilled water pump operation:
   1. Lead pump designation: Lead pump designation shall alternate between CHWP-1A and CHWP-1B every 500 hours of accumulated run-time. Lag pump shall remain de-energized unless lead pump failure is indicated by loss of pump status.
   2. Upon loss of pump status, alarm shall be generated.
   3. Lead pump shall be started when outside air temperature is above chilled water pump enable setpoint, and when there is a call for cooling at AHU-1 chilled water coil valve. Outside air enable setpoint (adj.) shall be initially set to 60 deg. F.

C. Chiller control: Chiller capacity controls and safeties shall be via existing internal controls. Chilled water temperature control shall be remotely established via DDC-resident chilled water temperature reset schedule and interface between the DDC and the existing chiller control panel.
   1. Chilled water temperature reset schedule: Chilled water temperature setpoint shall be dynamically reset between adjustable minimum and maximum setpoints based on deviation from supply air temperature setpoint in AHU-1. Initial reset parameters shall be as follows.
      a. Maximum setpoint: 52 deg. F
      b. Minimum setpoint: 42 deg. F

c. Deviation above SAT setpoint that triggers reset: 2 deg. F
d. Polling time interval: 5 minutes
e. Reset increment: 1 deg. F

3.04 POTABLE HOT WATER SYSTEM

A. General: A single central electric 15 kW water heater with 80 gallons of integral storage is located adjacent to AHU-1 and is installed with re-circulation pump (HB-1-CT04). Water heater temperature control shall remain as exists under internal thermostatic control. Re-circulation pump operation shall be controlled by DDC.

B. Re-circulation pump operation: Re-circulation pumps shall be operated on a time schedule corresponding to occupied period, inclusive of custodial periods. Initial time schedule shall be programmed as follows.
1. Pumps on: 7 AM to 10:00 pm, Monday through Friday
2. Pumps off: All other hours.

3.05 UNIT HEATERS (UH-1, UH-2)

A. Single temperature room thermostat set at 55 degrees F maintains constant space temperature by cycling unit fan motor and energizing electric heating elements.
1. Integral thermostat continues fan operation until element temperature falls below 100 degrees F.

PART 4 POINTS LIST (ATTACHED)

END OF SECTION

SECTION 23 21 13
HYDRONIC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Hydronic system requirements.

B. Chilled water piping, above grade.

C. Pipe and pipe fittings for:
   1. Chilled water piping system.
   2. Equipment drains and overflows.

D. Pipe hangers and supports.

E. Unions, flanges, mechanical couplings, and dielectric connections.

F. Valves:
   1. Gate valves.
   2. Globe or angle valves.
   3. Ball valves.
   4. Butterfly valves.
   5. Check valves.

G. Flow controls.

1.02 RELATED REQUIREMENTS

A. Section 08 31 00 - Access Doors and Panels.

B. Section 22 05 53 - Identification for Plumbing Piping and Equipment.

C. Section 23 05 16 - Expansion Fittings and Loops for HVAC Piping.

D. Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment.

E. Section 23 05 53 - Identification for HVAC Equipment.

F. Section 23 07 19 - HVAC Piping Insulation.

G. Section 23 09 13 - Instrumentation and Control Devices for HVAC

H. Section 23 25 00 - HVAC Water Treatment: Pipe cleaning.

1.03 REFERENCE STANDARDS

A. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; The American Society of Mechanical Engineers; 2011.

B. ASME B16.3 - Malleable Iron Threaded Fittings; The American Society of Mechanical Engineers; 1998 (R2006).

C. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; The American Society of Mechanical Engineers; 2012 (ANSI B16.18).

D. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings; 2013.

E. ASME B31.9 - Building Services Piping; 2014 (ANSI/ASME B31.9).

F. ASME B31.9 - Building Services Piping; The American Society of Mechanical Engineers; 2008 (ANSI/ASME B31.9).

G. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.

H. ASTM A536 - Standard Specification for Ductile Iron Castings; 1984 (Reapproved 2009).

I. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2014.

J. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2013.

K. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120; 2012.

L. ASTM D2241 - Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series); 2009.

M. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40; 2013.

N. ASTM D2467 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80; 2006.

O. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings; 1996 (Reapproved 2010).

P. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers; 1992 (Reapproved 2008).

Q. ASTM F1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications; 2007 (Reapproved 2013).

R. AWWA C110/A21.10 - Ductile-Iron and Gray-Iron Fittings; American Water Works Association; 2012.

S. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; American Water Works Association; 2012 (ANSI/AWWA C111/A21.11).

T. AWWA C606 - Grooved and Shouldered Joints; 2011 (ANSI/AWWA C606).

U. AWWA C606 - Standard Specification for Grooved and Shouldered Joints; American Water Works Association; 2006.

V. MSS SP-58 - Pipe Hangers and Supports - Materials, Design and Manufacture, Selection, Application, and Installation; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2009.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the installation of _____ with size, location and installation of service utilities.

B. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

C. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Include data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalogue information. Indicate valve data and ratings.

C. Product Data:
   1. Include data on pipe materials, pipe fittings, valves, and accessories.
   2. Provide manufacturers catalogue information.
   3. Indicate valve data and ratings.
   4. Show grooved joint couplings, fittings, valves, and specialties on drawings and product submittals, specifically identified with the manufacturer's style or series designation.

D. Project Record Documents: Record actual locations of valves.

E. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

F. Substitutions: See Section 01 60 00 - Product Requirements.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with minimum three years of documented experience.

B. Provide all grooved joint couplings, fittings, valves, specialties, and grooving tools from a single manufacturer, except where a control device is specified in 23 09 13.

1.07 REGULATORY REQUIREMENTS

A. Conform to ASME B31.9 code for installation of piping system.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.01 HYDRONIC SYSTEM REQUIREMENTS

A. Comply with ASME B31.9 and applicable federal, state, and local regulations.

B. Piping: Provide piping, fittings, hangers and supports as required, as indicated, and as follows:
   1. Where more than one piping system material is specified, provide joining fittings that are compatible with piping materials and ensure that the integrity of the system is not jeopardized.
   2. Use non-conducting dielectric connections whenever jointing dissimilar metals.
   3. Grooved mechanical joints may be used in accessible locations only.
      a. Accessible locations include those exposed on interior of building, in pipe chases, and in mechanical rooms, aboveground outdoors, and as approved by Architect.
      b. Grooved mechanical connections and joints comply with AWWA C606.
         1) Ductile Iron: Comply with ASTM A536, Grade 65-45-12.
      c. Use rigid joints unless otherwise indicated.
   4. Provide pipe hangers and supports in accordance with ASME B31.9 or MSS SP-58 unless indicated otherwise.
   5. Provide pipe hangers and supports in accordance with ASME B31.9 unless indicated otherwise.

C. Pipe-to-Valve and Pipe-to-Equipment Connections: Use flanges, unions, or grooved couplings to allow disconnection of components for servicing; do not use direct welded, soldered, or threaded connections.
   1. Where grooved joints are used in piping, provide grooved valve/equipment connections if available; if not available, provide flanged ends and grooved flange adapters.

D. Valves: Provide valves where indicated:
   1. Isolate equipment using butterfly valves with lug end flanges or grooved mechanical couplings.
   2. For throttling, bypass, or manual flow control services, use globe, ball, or butterfly valves.

2.02 CHILLED WATER PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M, Schedule 40, black; using one of the following joint types:
   1. Threaded Joints: ASME B16.3, malleable iron fittings.
   2. Grooved Joints: AWWA C606 grooved pipe, fittings of same material, and mechanical couplings.

2.03 EQUIPMENT DRAINS AND OVERFLOWS

A. Steel Pipe: ASTM A53/A53M, Schedule 40 galvanized; using one of the following joint types:
   1. Threaded Joints: Galvanized cast iron, or ASME B16.3 malleable iron fittings.

B. Copper Tube: ASTM B88 (ASTM B88M), Type M (C), drawn; using one of the following joint types:
   1. Solder Joints: ASME B16.18 cast brass/bronze or ASME B16.22 solder wrought copper fittings; ASTM B32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.

2. Grooved Joints: AWWA C606 grooved pipe, fittings of same material, and mechanical couplings.

C. PVC Pipe: ASTM D1785, Schedule 40, or ASTM D2241, SDR 21 or 26.
1. Fittings: ASTM D2466 or D2467, PVC.
2. Joints: Solvent welded in accordance with ASTM D2855.

2.04 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.
1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.

B. Conform to ASME B31.9.

C. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch: Carbon steel, adjustable swivel, split ring.

D. Hangers for Cold Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.

E. Hangers for Hot Pipe Sizes 2 to 4 Inches: Carbon steel, adjustable, clevis.

F. Hangers for Hot Pipe Sizes 6 Inches and Over: Adjustable steel yoke, cast iron roll, double hanger.

G. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

H. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.

I. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.

J. Vertical Support: Steel riser clamp.

K. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.

L. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

M. In grooved installations, use rigid couplings with offsetting angle-pattern bolt pads or with wedge shaped grooves in header piping to permit support and hanging in accordance with ASME B31.9.

2.05 UNIONS, FLANGES, MECHANICAL COUPLINGS, AND DIELECTRIC CONNECTIONS

A. Unions for Pipe 2 Inches and Under:
1. Ferrous Piping: 150 psig malleable iron, threaded.
2. Copper Pipe: Bronze, soldered joints.

B. Flanges for Pipe Over 2 Inches:
1. Ferrous Piping: 150 psig forged steel, slip-on.
2. Copper Piping: Bronze.
3. Gaskets: 1/16 inch thick preformed neoprene.

C. Mechanical Couplings for Grooved and Shouldered Joints: Two or more curved housing segments with continuous key to engage pipe groove, circular C-profile gasket, and bolts to secure and compress gasket.
1. Dimensions and Testing: In accordance with AWWA C606.
2. Mechanical Couplings: Comply with ASTM F1476.
3. Gasket Material: EPDM suitable for operating temperature range from -30 degrees F to 230 degrees F.
4. Bolts and Nuts: Hot dipped galvanized or zinc-electroplated steel.
5. When pipe is field grooved, provide coupling manufacturer's grooving tools.

D. Dielectric Connections: Union or waterway fitting with water impervious isolation barrier and one galvanized or plated steel end and one copper tube end, end types to match pipe joint types used.

2.06 OS&Y GATE VALVES

A. Manufacturers:

1. Hammond IR 114
2. Apollo
3. Crane
4. Nibco
5. Substitutions: See Section 01 60 00 - Product Requirements.

B. Over 2 Inches:
1. Iron body, bronze trim, bolted bonnet, rising stem, handwheel, outside screw and yoke, solid wedge disc with bronze seat rings, flanged ends.

2.07 GLOBE OR ANGLE VALVES

A. Manufacturers:
1. Belimo; Model G7: www.belimo.us.
2. Substitutions: See Section 01 60 00 - Product Requirements.

B. Over 2 Inches:
1. Iron body, bronze trim, stainless steel stem, bronze plug.

2.08 BALL VALVES

A. Manufacturers:
1. Hammond 8301 (threaded) or 8311 (soldered)
2. Apollo
3. Nibco
4. Milwaukee
5. Legend
6. Victaulic Company; Model ____: www.victaulic.com.
7. Substitutions: See Section 01 60 00 - Product Requirements.

B. Up To and Including 2 inches:
1. Bronze two piece body, full port, chrome plated brass ball, teflon seats and stuffing box ring, lever handle with balancing stops, solder or threaded ends with union.

2.09 BUTTERFLY VALVES

A. Manufacturers:
1. Hammond 5211
2. Apollo
3. Nibco
4. Crane
5. Milwaukee
6. Legend
7. Victaulic Company; Model Series 700: www.victaulic.com.
8. Substitutions: See Section 01 60 00 - Product Requirements.

B. Body: Cast or ductile iron butterfly valves, with grooved ends, shall be incorporated wherever possible, in lieu of wafter, lug, or flanged-type valves. Valves shall have grooved ends designed to accept grooved mechanical couplings (from the same manufacturer) without field preperation.

C. Operating Conditions: Not to exceed –30°F to +230°F/–34°C to +110°C temperature range according to the valve lining selected (refer to manufacturer's data) and must provide service from 29.9 inches of mercury vacuum service through 200psi/1400kPa. Shut-off must be bubble-tight to full pressure rating and provide dead-end service.

D. Disc: Aluminum bronze.

E. Stem: 416 stainless steel

F. Operator: lever or wheel depending on valve size.

2.10 SWING CHECK VALVES

A. Manufacturers: Hammond as noted, Nibco, Milwaukee, Legend, or approved.

1. Hammond as noted
2. Apollo
3. Nibco
4. Milwaukee
5. Legend
6. Substitutions: See Section 01 60 00 - Product Requirements.

B. Up To and Including 2 Inches:
1. Bronze body, bronze trim, bronze rotating swing disc, with composition disc, solder or threaded ends. Hammond IB945 (soldered) or IB940 (threaded)

C. Over 2 Inches:
1. Iron body, bronze or _____ trim, stainless steel, bronze, bronze faced rotating, or _____ swing disc, renewable disc and seat, flanged, grooved, or _____ ends.
2. Iron body, bronze trim, bronze or bronze faced rotating swing disc, renewable disc and seat, flanged ends. Hammond IR1124.

2.11 SPRING LOADED CHECK VALVES

A. Manufacturers: Hammond as noted, Nibco, Milwaukee, Legend, or approved.
1. Hammond as noted
2. Apollo
3. Nibco
4. Milwaukee
5. Legend
6. Substitutions: See Section 01 60 00 - Product Requirements.

B. Up To and Including 2 inches:
1. Bronze body; bronze trim, split plate, hinged with stainless steel spring; resilient seal bonded to body; Hammond 947 (screwed) or 943 (soldered)

C. Over 2 inches: Iron body, bronze trim, split plate, hinged with stainless steel spring, resilient seal bonded to body, wafer or threaded lug ends. Hammond IR9253.

2.12 FLOW CONTROLS

A. Manufacturers:
1. Belimo Company; Model ____: www.belimo.us.

B. Construction: Class 125, Brass or bronze body with union on inlet and outlet, temperature and pressure test plug on inlet and outlet, blowdown/backflush drain.

C. Calibration: Control flow within 5 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, maximum minimum pressure 3.5 psi.

PART 3 EXECUTION

3.01 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Prepare pipe for grooved mechanical joints as required by coupling manufacturer.

C. Remove scale and dirt on inside and outside before assembly.

D. Prepare piping connections to equipment using jointing system specified.

E. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

F. After completion, fill, clean, and treat systems. Refer to Section 23 25 00 for additional requirements.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Route piping in orderly manner, parallel to building structure, and maintain gradient.

C. Install piping to conserve building space and to avoid interfere with use of space.

D. Group piping whenever practical at common elevations.

E. Slope piping and arrange to drain at low points.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 22 05 16.

G. Grooved Joints:
   1. Install in accordance with the manufacturer's latest published installation instructions.
   2. Gaskets to be suitable for the intended service, molded, and produced by the coupling manufacturer.

H. Inserts:
   1. Provide inserts for placement in concrete formwork.
   2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
   3. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.

I. Pipe Hangers and Supports:
   1. Install in accordance with ASME B31.9, ASTM F708, or MSS SP-58.
   2. Support horizontal piping at spacing as required by Code.
   3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
   4. Place hangers within 12 inches of each horizontal elbow.
   5. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
   6. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
   7. Provide copper plated hangers and supports for copper piping.

J. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 22 07 19.

K. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with Section 08 31 00.

L. Provide stem extensions for ball valves installed on insulated lines.

M. Provide memory stops for all valves to be used for balancing.

N. Install butterfly valves with stem at the horizontal, and so that the handle points down when closed and in the direction of flow when in the open position.

O. Adjust all packing nuts after installation.
   1. Provide lever handles for 6” and smaller butterfly valves.
   2. Provide gear operator for 8” and larger butterfly valves.

P. Provide chain wheel operator when valve is positioned 7 feet or more above floor level.

Q. Provide swing check valves where installed in horizontal position or vertically, facing up. Provide spring check valves where installed vertically, facing down.

3.03 SCHEDULES

A. Hanger Spacing for Steel Piping.
   1. 4 inches: Maximum span, 14 feet; minimum rod size, 1/2 inch.
   2. 6 inches: Maximum span, 17 feet; minimum rod size, 1/2 inch.

END OF SECTION

SECTION 23 21 14
HYDRONIC SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Strainers.

B. Suction diffusers.

C. Combination pump discharge valves.

D. Pressure-temperature test plugs.

E. Combination flow controls.

F. Pump suction fittings.

G. Combination fittings.

H. Balancing valves

I. Automatic control valves

J. Consolidated fittings

K. Differential pressure bypass valves

L. Glycol system.

1.02 RELATED REQUIREMENTS

A. Section 23 21 13 - Hydronic Piping.

B. Section 23 25 00 - HVAC Water Treatment: Pipe Cleaning .

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the installation of _____ with size, location and installation of service utilities.

B. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

C. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide product data for manufactured products and assemblies required for this project. Include component sizes, rough-in requirements, service sizes, and finishes. Include product description, model and dimensions.

C. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.

D. Project Record Documents: Record actual locations of flow controls and flow meters.

E. Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

F. Substitutions: See Section 01 60 00 - Product Requirements.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.01 STRAINERS

A. Manufacturers: Mueller as noted, Armstrong, Metraflex, or approved.
   1. Substitutions: See Section 01 60 00 - Product Requirements.

B. Size 2-1/2 inch to 4 inch:
   1. Provide grooved iron body for 175 psi working pressure, Y pattern with 1/16 inch, 3/64 inch, or ____ inch stainless steel perforated screen.

2.02 SUCTION DIFFUSERS

A. Manufacturers: Bell and Gossett, Taco, Armstrong, Paco, or approved.
   1.

B. Fitting: Angle pattern, cast-iron body, threaded for 2 inch and smaller, flanged for 2-1/2 inch and larger, rated for 175 psi working pressure, with inlet vanes, cylinder strainer with 3/16 inch diameter openings, disposable 5/32 inch mesh strainer to fit over cylinder strainer, 20 mesh start up screen, and permanent magnet located in flow stream and removable for cleaning.

C. Fitting: Angle pattern, cast-iron body, threaded for 2 inch and smaller, flanged for 2-1/2 inch and larger, rated for 175 psi working pressure, with inlet vanes, cylinder strainer with 3/16 inch diameter openings, disposable fine mesh strainer to fit over cylinder strainer, and permanent magnet located in flow stream and removable for cleaning.

D. Accessories: Adjustable foot support, blowdown tapping in bottom, gage tapping in side.

2.03 COMBINATION PUMP DISCHARGE VALVES

A. Manufacturers: Bell and Gossett, Taco, Armstrong, Paco, or approved.
   1. Victaulic Company of America; _____: www.victaulic.com.

B. Valves: Straight or angle pattern, flanged cast-iron valve body with bolt-on bonnet for 175 psi operating pressure, non-slam check valve with spring-loaded bronze disc and seat, stainless steel stem, and calibrated adjustment permitting flow regulation.

2.04 PRESSURE-TEMPERATURE TEST PLUGS

A. Manufacturers:
   1. Peterson Equipment Company Inc; _____: www.petesplug.com.
   2. Sisco Manufacturing Company Inc; _____: www.siscomfg.com.
   3. Ferguson Enterprises Inc; _____: www.fnw.com.

B. Construction: Brass body designed to receive temperature or pressure probe with removable protective cap, and Neoprene rated for minimum 200 degrees F.

C. Application: Use extended length plugs to clear insulated piping.

2.05 COMBINATION FLOW CONTROLS

A. Construction: Brass or bronze body with union on inlet and outlet, temperature and pressure test plug on inlet and outlet with blowdown/backflush drain.

B. Calibration: Control flow within 5 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, maximum minimum pressure 3.5 psi.

C. Control Mechanism: Stainless steel or nickel plated brass piston or regulator cup, operating against stainless steel helical or wave formed spring.

2.06 MANUAL BALANCING VALVES - 2 INCH AND LARGER

A. Manufacturers: Flow Design Flowset Accusetter Models AF, AG, or AW, or approved.

B. Type: Butterfly valve equipped with venturi and graduated memory stop,

C. Venturi Construction: Steel body, low-loss piezo-ring throat.

D. Valve Construction: Cast iron, lug-type body, class 150, EPDM seat and gasket, 410 stainless steel stem, nylon bearings, bronze disc.

E. Instrument ports: Extended P/T test ports.

F. Accuracy: Plus or minus 3 percent of full scale.

G. Rating: 240 psig at 250F

2.07 AUTOMATIC CONTROL VALVES

A. Manufacturers: Griswold Unimizer 2-Way, Flow Design, or approved.

B. Type: Two-position full-port ball valve

C. Construction: Forged brass body, ASTM B283, brass end connections and stem, nickel-plated brass ball, Teflon seals with EPDM o-rings.

D. Actuator: By Controls Contractor.

E. Size: As scheduled (or otherwise indicated).

2.08 CONSOLIDATED FITTINGS

A. Manufacturers: Griswold as noted below, Flow Design, Nexus, or approved.

B. Description: Pre-assembled assemblies of hydronic components as described below:

C. Assembly “A”: Ball valve and integrated strainer with 20 mesh stainless steel screen. Valve with one fixed connection and one union connection. Union end includes union nut and EPDM o-ring. Body has one 0.5 inch tapped port with one pressure/temperature test valve. Assembly to include drain valve with 0.75 inch hose connection with cap. Griswold Space Saver S

D. Assembly “B”: Automatic balancing valve as above with integrated ball valve. Valve includes one fixed end connection and one union connection. Union end includes union nut and EPDM o-ring. Valve body has two 0.25 inch tapped ports with two pressure/temperature test valves. Griswold Space Saver R.

E. Assembly “C”: Forged brass union with one fixed end connection and one union connection. Union includes union nut and EPDM o-ring. Union body has two 0.25 inch tapped ports with one manual air vent and one with pressure/temperature test valve. Griswold Union with +PT option.

F. Assembly "D": Same as assembly "A" but including branch with manual balancing valve and union for 3-way valve service.

2.09 DIFFERENTIAL PRESSURE BYPASS VALVES

A. Manufacturers: Honeywell D146M, or approved.

B. Description: Manually settable valve used to limit pressure in hydronic systems.

C. Features: Built in pressure indicator, regulating cap.

D. Range: 230 F maximum temperature, 85 psi maximum pressure, 0-17 psi differential pressure range.

E. Size: As indicated.

2.10 FEED WATER PRESSURE REGULATOR

A. Manufacturers: Watts Model 1156, or approved.

B. Boiler makeup water feed valve and system pressure regulator.

C. Body: Bronze

D. Features: Purge lever, stainless steel strainer, threaded or solder inlet.

2.11 GLYCOL SYSTEM

A. Mixing Tank: 55 gallon steel drum with fittings suitable for filling and hand pump for charging, rubber hose for connection of hand pump to system.

B. Storage Tank: Closed type, welded steel constructed, tested and stamped in accordance with ASME BPVC-VIII-1; 100 psi rating; cleaned, prime coated, and supplied with steel support saddles. Construct with tappings for installation of accessories.

C. Expansion Tank: Diaphragm type with vent fitting with air separator, and automatic air vent.

D. Air Pressure Reducing Station: Pressure reducing valve with shut-off valves, strainer, check valve and needle valve bypass.

E. Glycol Solution:
   1. Inhibited ethylene glycol and water solution mixed 50 percent glycol - 50 percent water, suitable for operating temperatures from minus 40 degrees F to 250 degrees F.

PART 3 EXECUTION

3.01 INSTALLATION

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

B. Provide automatic air vents at system high points and as indicated.

C. Provide valved drain and hose connection on strainer blow down connections.

D. Provide pump suction fitting on suction side of base mounted centrifugal pumps where indicated. Remove temporary strainers after cleaning systems.

E. Provide combination pump discharge valve on discharge side of base mounted centrifugal pumps where indicated.

F. Select system relief valve capacity so that it is greater than make-up pressure reducing valve capacity. Select equipment relief valve capacity to exceed rating of connected equipment.

G. Pipe relief valve outlet to nearest floor drain.

H. Where one line vents several relief valves, make cross sectional area equal to sum of individual vent areas.

I. Clean and flush glycol system before adding glycol solution. Refer to Section 23 25 00.

J. Install balancing valves so that test ports are accessible for reading.

K. Feed glycol solution to system through make-up line with pressure regulator, venting system high points.

L. Perform tests determining strength of glycol and water solution and submit written test results.

END OF SECTION

SECTION 23 21 23
HYDRONIC PUMPS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Base mounted pumps.

1.02 RELATED REQUIREMENTS

A. Section 23 05 13 - Common Motor Requirements for HVAC Equipment.

B. Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment.

C. Section 23 07 19 - HVAC Piping Insulation.

D. Section 23 21 13 - Hydronic Piping.

E. Section 23 21 14 - Hydronic Specialties.

F. Section 26 27 17 - Equipment Wiring: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association; 2014.

B. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. UL 778 - Standard for Motor-Operated Water Pumps; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide certified pump curves showing performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements.

C. Operation and Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacture, assembly, and field performance of pumps, with minimum three years of documented experience.

1.06 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by UL 778 as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. ITT Bell & Gossett; Model VSX 4x5x10.5: www.bellgossett.com.

B. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 HVAC PUMPS - GENERAL

A. Provide pumps that operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

B. Products Requiring Electrical Connection: Listed and classified by UL or testing agency acceptable to authority having jurisdiction as suitable for the purpose specified and indicated.

2.03 BASE MOUNTED PUMPS

A. Manufacturers: Bell & Gossett Series VSX, or approved.

B. Type: Horizontal shaft, single stage, direct connected, radially split casing, for 125 psi maximum working pressure.

C. Casing: Cast iron, with suction and discharge gage ports, renewable bronze casing wearing rings, seal flush connection, drain plug, flanged suction and discharge.

D. Impeller: Bronze, fully enclosed, keyed to shaft.

E. Bearings: Oil lubricated roller or ball bearings.

F. Shaft: Alloy steel with copper, bronze, or stainless steel shaft sleeve.

G. Seal: Mechanical seal, 225 degrees F maximum continuous operating temperature.

H. Drive: Flexible coupling with coupling guard.

I. Baseplate: Cast iron or fabricated steel with integral drain rim.

J. Performance: As scheduled.
   1. Flow Capacity: _____ gal/min.
   2. Head: _____ feet head.

K. Electrical Characteristics:
   1. 5 hp.
   2. 480 volts, three phase, 60 Hz.
   3. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70.

PART 3 EXECUTION

3.01 PREPARATION

A. Verify that electric power is available and of the correct characteristics.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide access space around pumps for service. Provide no less than minimum space recommended by manufacturer.

C. Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings. For close coupled or base mounted pumps, provide supports under elbows on pump suction and discharge line sizes 4 inches and over.

D. Provide line sized shut-off valve and strainer on pump suction, and line sized soft seat check valve and balancing valve on pump discharge.

E. Check, align, and certify alignment of base mounted pumps prior to start-up.

F. Lubricate pumps before start-up.

3.03 SCHEDULES

A. Pumps
   1. Drawing Code: M800

END OF SECTION

SECTION 23 25 00

HVAC WATER TREATMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cleaning of piping systems.

B. Chemical feeder equipment.

C. Chemical treatment.

1.02 RELATED REQUIREMENTS

A. Section 01 10 00 - Summary: Owner furnished treatment equipment.

B. Section 01 60 00 - Product Requirements: Owner furnished treatment equipment.

C. Section 23 21 13 - Hydronic Piping.

D. Section 23 21 14 - Hydronic Specialties.

E. Section 23 09 13 - Instrumentation and Control Devices for HVAC.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide chemical treatment materials, chemicals, and equipment including electrical characteristics and connection requirements.

C. Manufacturer's Field Reports: Indicate start-up of treatment systems when completed and operating properly. Indicate analysis of system water after cleaning and after treatment.

D. Certificate: Submit certificate of compliance from authority having jurisdiction indicating approval of chemicals and their proposed disposal.

E. Project Record Documents: Record actual locations of equipment and piping, including sampling points and location of chemical injectors.

F. Operation and Maintenance Data: Include data on chemical feed pumps, agitators, and other equipment including spare parts lists, procedures, and treatment programs. Include step by step instructions on test procedures including target concentrations.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience. Company shall have local representatives with water analysis laboratories and full time service personnel.

1.05 REGULATORY REQUIREMENTS

A. Conform to applicable code for addition of non-potable chemicals to building mechanical systems and to public sewage systems.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. AmSolv/Division of Amrep, Inc; Model _____: www.amsolv.com.

B. GE Water Technologies; Model _____: www.gewater.com.

C. Nalco Company; Model _____: www.nalco.com.

D. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 MATERIALS

2.03 BY-PASS (POT) FEEDER

A. Manufacturers:

1. Griswold Controls; Model _____: www.griswoldcontrols.com.
2. J. L. Wingert Company; Model _____: www.jlwingert.com.
3. Neptune Chemical Pump Company; Model _____: www.neptune1.com.

4. Substitutions: See Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 PREPARATION

A. Systems shall be operational, filled, started, and vented prior to cleaning. Use water meter to record capacity in each system.

B. Place terminal control valves in open position during cleaning.

C. Verify that electric power is available and of the correct characteristics.

3.02 CLEANING SEQUENCE

A. Concentration:
   1. As recommended by manufacturer.

B. Chilled Water Systems:
   1. Circulate for 48 hours, then drain systems as quickly as possible.
   2. Refill with clean water, circulate for 24 hours, then drain.
   3. Refill with clean water and repeat until system cleaner is removed.

C. Use neutralizer agents on recommendation of system cleaner supplier and approval of Architect.

D. Remove, clean, and replace strainer screens.

E. Inspect, remove sludge, and flush low points with clean water after cleaning process is completed. Include disassembly of components as required.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

3.04 CLOSED SYSTEM TREATMENT

A. Provide one bypass feeder on each system. Install isolating and drain valves and necessary piping. Install around balancing valve downstream of circulating pumps unless indicated otherwise.

B. Introduce closed system treatment through bypass feeder when required or indicated by test.

C. Provide 3/4 inch water coupon rack around circulating pumps with space for 4 test specimens.

END OF SECTION

SECTION 23 31 00
HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal ductwork.

B. Nonmetal ductwork.

C. Casing and plenums.

D. Duct cleaning.

1.02 RELATED REQUIREMENTS

A. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 23 01 30.51 - HVAC Air Duct Cleaning: Cleaning ducts after completion of installation.

C. Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC.

D. Section 23 07 13 - Duct Insulation: External insulation and duct liner.

E. Section 23 33 00 - Air Duct Accessories.

F. Section 23 36 00 - Air Terminal Units.

G. Section 23 37 00 - Air Outlets and Inlets.

1.03 REFERENCE STANDARDS

A. ASHRAE (FUND) - ASHRAE Handbook - Fundamentals; 2013.

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

C. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes; 2013a.

D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2013.

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

F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2014.

G. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements; 2013.

H. ICC-ES AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements; 2013.

I. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; National Fire Protection Association; 2012.

J. NFPA 90B - Standard for the Installation of Warm Air Heating and Air Conditioning Systems; National Fire Protection Association; 2012.

K. OEESC - Oregon Energy Efficiency Specialty Code; 2010

L. SMACNA (DCS) - HVAC Duct Construction Standards; Sheet Metal and Air Conditioning Contractors' National Association; 2005.

M. SMACNA (LEAK) - HVAC Air Duct Leakage Test Manual; Sheet Metal and Air Conditioning Contractors' National Association; 2012, 2nd Edition.

N. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

O. OMSC - Oregon Mechanical Specialty Code; 2010

1.04 PERFORMANCE REQUIREMENTS

A. No variation of duct configuration or sizes permitted except by written permission. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for duct materials and duct connections.

C. Shop Drawings: Indicate duct fittings, particulars such as gages, sizes, welds, and configuration prior to start of work for _____ pressure class and higher systems.

D. Test Reports: Indicate pressure tests performed. Include date, section tested, test pressure, and leakage rate, following SMACNA (LEAK).

E. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience, and approved by manufacturer.

B. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum ___ years of documented experience.

1.07 FIELD CONDITIONS

A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.

B. Maintain temperatures within acceptable range during and after installation of duct sealants.

PART 2 PRODUCTS

2.01 DUCT ASSEMBLIES

A. All Ducts: Galvanized steel, unless otherwise indicated.

2.02 MATERIALS

A. Galvanized Steel for Ducts: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G60/Z180 coating.

B. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant, zero VOC.
   1. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts.
   2. VOC Content: Not more than 250 g/L, excluding water.
   3. Surface Burning Characteristics: Flame spread of zero, smoke developed of zero, when tested in accordance with ASTM E84.
   4. Products:
      a. Carlisle HVAC Products; Hardcast Iron-Grip 601 Water Based Duct Sealant: www.carlislehvac.com.
      b. Design Polymerics; DP 1010 Water Based Duct Sealant: www.designpoly.com.

C. Hanger Rod: ASTM A36/A36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

D. Hanger Fasteners: Attach hangers to structure using appropriate fasteners, as follows:
   1. Concrete Wedge Expansion Anchors: Complying with ICC-ES AC193.
   2. Concrete Screw Type Anchors: Complying with ICC-ES AC193.
   3. Other Types: As required.

E. Insulated Flexible Ducts:

1. Manufacturers: JP Lamborn Model PR-25, flexmaster Type 5, or approved.
2. Black polymer film supported by helically wound spring steel wire; fiberglass insulation; polyethylene vapor barrier film.
    a. Pressure Rating: 4 inches WG positive and 0.5 inches WG negative.
    b. Maximum Velocity: 4000 fpm.
    c. Temperature Range: -20 degrees F to 175 degrees F.

2.03 DUCTWORK FABRICATION

A. Transfer Air and Sound Boots: 1/2 inch w.g. pressure class, fibrous glass.

B. Fabricate and support in accordance with SMACNA HVAC Duct Construction Standards and to meet Section 503.2.7.1 of the OEESC

C. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

D. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide air foil turning vanes of perforated metal with glass fiber insulation.

E. Provide turning vanes of perforated metal with glass fiber insulation when acoustical lining is indicated.

F. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

G. Fabricate continuously welded round and oval duct fittings in accordance with SMACNA (DCS).

H. All ducts and plenums shall be sealed. Joints and seams shall comply with Section 603.9 of the OMSC and 503.2.7.1 of the OEESC.

2.04 MANUFACTURED DUCTWORK AND FITTINGS

A. Manufacture in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gages,reinforcing, and sealing for operating pressures indicated.

B. Transverse Duct Connection System: SMACNA "E" rated rigidly class connection, interlocking angle and duct edge connection system with sealant, gasket, cleats, and corner clips.
    1. Manufacturers:
        a. Elgen Manufacturing; _____: www.elgenmfg.com.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install, support, and seal ducts in accordance with SMACNA (DCS).

B. Install in accordance with manufacturer's instructions.

C. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

D. Flexible Ducts: Connect to metal ducts with silicone sealer and draw bands.

E. Duct sizes indicated are inside clear dimensions. For lined ducts, maintain sizes inside lining.

F. Install and seal metal and flexible ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

G. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.

H. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

I. Use double nuts and lock washers on threaded rod supports.

J. Connect terminal units to supply ducts directly or with one foot maximum length of flexible duct. Do not use flexible duct to change direction.

K. Connect diffusers to low pressure ducts with 6 feet maximum length of flexible duct held in place with strap or clamp.

L. Set plenum doors 6 to 12 inches above floor. Arrange door swings so that fan static pressure holds door in closed position.

M. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

3.02 CLEANING

A. Clean duct systems with high power vacuum machines. Protect equipment that could be harmed by excessive dirt with filters, or bypass during cleaning. Provide adequate access into ductwork for cleaning purposes.

3.03 SCHEDULES

A. Ductwork Material:
   1. Low Pressure Supply: Steel.
   2. Medium Pressure Supply: Steel.
   3. Return and Relief: Steel.
   4. General Exhaust: Steel.
   5. Outside Air Intake: Steel.

B. Ductwork Pressure Class:
   1. Low Pressure Supply: 2 inch w.g. pressure class, galvanized steel.
   2. Medium Pressure Supply: 4 inch w.g. pressure class, galvanized steel.
   3. Return and Relief: 1 inch. w.g. pressure class, galvanized steel.
   4. General Exhaust: 1 inch. w.g. pressure class, galvanized steel.
   5. Outside Air Intake: 1 inch. w.g. pressure class, galvanized steel.

END OF SECTION

SECTION 23 33 00
AIR DUCT ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Air turning devices
B. Backdraft dampers - metal.
C. Combination fire and smoke dampers.
D. Duct access doors.
E. Duct test holes.
F. Flexible duct connections.
G. Volume control dampers.
H. Control dampers.

1.02 RELATED REQUIREMENTS

A. Section 07 84 00 - Firestopping.
B. Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment.
C. Section 23 31 00 - HVAC Ducts and Casings.
D. Section 23 36 00 - Air Terminal Units: Pressure regulating damper assemblies.
E. Section 26 27 17 - Equipment Wiring: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; National Fire Protection Association; 2012.
B. NFPA 92 - Standard for Smoke-Control Systems; 2012.
C. SMACNA (DCS) - HVAC Duct Construction Standards; 2005.
D. UL 555 - Standard for Fire Dampers; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.
E. UL 555S - Standard for Leakage Rated Dampers for Use in Smoke Control Systems; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide for shop fabricated assemblies including volume control dampers. Include electrical characteristics and connection requirements.
C. Shop Drawings: Indicate for shop fabricated assemblies including volume control dampers.
D. Project Record Drawings: Record actual locations of access doors and test holes.
E. Substitutions: See Section 01 60 00 - Product Requirements.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.
B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect dampers from damage to operating linkages and blades.

PART 2 PRODUCTS

2.01 AIR TURNING DEVICES

A. Manufacturers: Durodyne, Sheet Metal Connectors Inc, or approved.
   1. Carlisle HVAC Products; Dynair Hollow Vane and Rail (Double Wall Vane): www.carlislehvac.com.
   2. Krueger; Model _____: www.krueger-hvac.com.
   3. Ruskin Company; Model _____: www.ruskin.com.
   4. Titus; Model _____: www.titus-hvac.com.

B. Multi-blade device with blades aligned in short dimension; steel construction, mounting straps.

2.02 BACKDRAFT DAMPERS - METAL

A. Multi blade turning vane assembly with blades aligned in short dimension; constructed of same material as ductwork in which installed, with individual vanes of the hollow airfoil type, with rails screwed into duct fitting. Vane length not to exceed 36 inches. Construct per SMACNA.

2.03 COMBINATION FIRE AND SMOKE DAMPERS

A. Manufacturers: Ruskin Model FSD36, Nailor, Greenheck, Cesco or approved.
   1. Nailor Industries Inc; Model _____: www.nailor.com.
   2. Ruskin Company; Model _____: www.ruskin.com.

B. Fabricate in accordance with NFPA 90A, UL 555, UL 555S, and as indicated.

C. Provide factory sleeve and collar for each damper.

D. Multiple Blade Dampers: Fabricate with 16 gage galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, stainless steel jamb seals, 1/8 x 1/2 inch plated steel concealed linkage, stainless steel closure spring, blade stops, and lock, and 1/2 inch actuator shaft.

E. Operators: UL listed and labelled fall close, spring return electric type suitable for 120 volts, single phase, 60 Hz. Provide end switches to indicate damper position. Locate damper operator on exterior of duct where practical, or interior if service clearance is not available, and link to damper operating shaft.

F. Mounting Position: Rated for verical or horizontal mounting, included with mounting sleeves.

G. Velocity rating: Rated for use in systems with airflow in either direction with velocities up to 2,000 feet per minute and pressures up to 4 inches w.g.

H. Electric resettable fuse link: Heat actuated release device to permit controlled closure through damper actuator, allowing damper to automatically reopen after test, smoke detection, or power failure condition.

I. Duct smoke detector: Photoelectric type, 120 volt, factory mounted on sleeve opposite to actuator and wired to actuator, suitable for minimum 300 feet per minute air velocity; similar to Ruskin DSDF.

J. For grille and diffuser applications, provide as above but with ability to gain front access to damper and actuator through grille. Delete smoke detector.

2.04 DUCT ACCESS DOORS

A. Manufacturers: ABI, Keys, or approved.
   1. Acudor Products Inc: www.acudor.com.
   2. Elgen Manufacturing; Model _____: www.elgenmfg.com.
   3. Nailor Industries Inc; Model _____: www.nailor.com.
   4. Ruskin Company; Model _____: www.ruskin.com.
   5. SEMCO Incorporated; Model _____: www.semcohvac.com.

B. Fabrication: Rigid and close-fitting of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ducts, install minimum 1 inch thick insulation with sheet metal cover.
   1. Less Than 12 inches Square: Secure with sash locks.

2. Up to 18 inches Square: Provide two hinges and two sash locks.
3. Up to 24 x 48 inches: Three hinges and two compression latches with outside and inside handles.
4. Larger Sizes: Provide an additional hinge.

2.05 DUCT TEST HOLES

A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

B. Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.
1. Products:
2. Carlisle HVAC Products; Dynair Test Port with Red Cap with O-Ring Seal: www.carlislehvac.com.

2.06 FIRE DAMPERS - RECTANGULAR, GRILLE ACCESS

A. Manufacturers"
1. Ruskin Model DIBD2GA, Greenheck, Cesco, Pottorff
2. Substitutions: See Section 01 60 00 - Product Requirements.

B. Ratings:
1. Fire Resistance: 1½ hours in accordance with UL 555
2. Dynamic Closure Rating: Classified for dynamic closure to 2000 fpm and 4 inches w.g. static pressure

C. Construction:
1. Frame: Maximum 5 inch roll formed, galvanized steel channel.
2. Sleeves: Single assembly with integral factory sleeve, 12 inches long.
3. Retaining Angles: Sized to provide installation overlap in accordance with manufacturer's UL listing.
4. Blades: Galvanized curtain type.
5. Closure Springs: Type 301 stainless steel, constant force or spring clip type.
6. Temperature Release Device: Fusible link, 165 degrees F
7. Duct Transition Connection, Damper Style:
   a. A style - rectangular connection, frame and blades in air stream.
   b. G style - A style connection, grille mounting tabs at end of sleeve for grille.
8. Mounting: Vertical
9. Finish: Mill galvanized.

2.07 FLEXIBLE DUCT CONNECTIONS

A. Manufacturers:
1. Carlisle HVAC Products; Dynair Connector Plus G90 Steel Offset Seam Neoprene Fabric: www.carlislehvac.com.
2. Elgen Manufacturing; Model _____: www.elgenmfg.com.

B. Fabricate in accordance with SMACNA (DCS) and as indicated.

C. Flexible Duct Connections: Fabric crimped into metal edging strip.
1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 oz per sq yd.
   a. Net Fabric Width: Approximately 2 inches wide.
2. Metal: 3 inches wide, 24 gage, 0.0239 inch thick galvanized steel.

2.08 VOLUME CONTROL DAMPERS

A. Manufacturers:

B. Fabricate in accordance with SMACNA (DCS) and as indicated.

C. Single Blade Dampers: Fabricate for duct sizes up to 6 x 30 inch.

D. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 x 72 inch. Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.

E. Quadrants:
   1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
   2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.
   3. Where rod lengths exceed 30 inches provide regulator at both ends.
   4. Products:

F. Regulator extensions: Where damper is located above inaccessible ceiling, provide extension arm, gear driver and ceiling mounted access plate.

2.09 MISCELLANEOUS PRODUCTS

A. Internal Strut End Plugs: Combination end-mounting and sealing plugs for metal conduit used as internal reinforcement struts for metal ducts; plug crimped inside conduit with outside gasketed washer seal.

B. Duct Opening Closure Film: Mold-resistant, self-adhesive film to keep debris out of ducts during construction.
   1. Thickness: 2 mils.
   2. High tack water based adhesive.

2.10 LOW-LEAK CONTROL DAMPERS (OSA, EA, RELIEF AIR)

A. Manufacturers: Ruskin CD50, Greenheck, Johnson, or approved.

B. Frames: 5 inches x 1 inch x minimum 0.125 inch 6063-T5 extruded aluminum hat-shaped channel, mounting flanges on both sides of frame, reinforced at corners.

C. Blades: Airfoil-shaped, single-piece 6063-T5 extruded aluminum

D. Jamb seals: Flexible stainless steel, compression type to prevent leakage between the end of the blade and the damper frame.

E. Bearings: Molded synthetic sleeve, turning in hole in frame.

F. Axles: ½" plated steel, hexagon shaped and positively locked into damper blades.

G. Linkage: Concealed in frame.

H. Leakage: Based on AMCA Publication 500, less than 3 cfm/sq. ft. at 1" of static pressure.

I. Pressure drop: Maximum 0.03 inch w.g. at 1,500 feet per minute across 24 inch x 24 inch damper.

J. Actuation: By Controls Contractor.

2.11 CONTROL DAMPERS (RA)

A. Manufacturers: Ruskin CD36, Greenheck, Johnson, or approved.

B. Frames: 5 inches x minimum 16 gage roll formed, galvanized steel hat-shaped channel, reinforced at corners.

C. Blades: Minimum 16 gage galvanized steel, single skin with 3 longitudinal grooves.

D. Bearings: Molded synthetic sleeve, turning in extruded hole in frame.

E. Seals:
   1. Blade: Inflatable PVC coated fiberglass material and galvanized steel. Mechanically attached to blade edge.
   2. Jamb: Flexible metal compression type

F. Linkage: Concealed in frame.

G. Axles: Minimum 1/2 inch diameter plated steel, hex-shaped, mechanically attached to blade.

H. Actuation: By Controls Contractor.

PART 3 EXECUTION

3.01 PREPARATION

A. Verify that electric power is available and of the correct characteristics.

3.02 INSTALLATION

A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). Refer to Section 23 31 00 for duct construction and pressure class.

B. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.

C. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, and elsewhere as indicated. Provide minimum 8 x 8 inch size for hand access, 18 x 18 inch size for shoulder access, and as indicated. Provide 4 x 4 inch for balancing dampers only. Review locations prior to fabrication.

D. Provide duct test holes where indicated and required for testing and balancing purposes.

E. Provide fire dampers, combination fire and smoke dampers, and smoke dampers at locations indicated, where ducts and outlets pass through fire rated components, and where required by authorities having jurisdiction. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.

F. Install smoke dampers and combination smoke and fire dampers in accordance with NFPA 92.

G. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.

H. At equipment supported by vibration isolators, provide flexible duct connections immediately adjacent to the equipment; see Section 23 05 49.

I. For fans developing static pressures of 5.0 inches and over, cover flexible connections with leaded vinyl sheet, held in place with metal straps.

J. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct take-off.

K. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

END OF SECTION

SECTION 23 34 16
CENTRIFUGAL HVAC FANS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Forward curved centrifugal fans.

B. Airfoil centrifugal fans.

C. Vent sets.

D. Motors and drives.

E. Fan accessories.

1.02 RELATED REQUIREMENTS

A. Section 22 05 13 - Common Motor Requirements for Plumbing Equipment.

B. Section 23 05 13 - Common Motor Requirements for HVAC Equipment.

C. Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment.

D. Section 23 07 13 - Duct Insulation.

E. Section 23 33 00 - Air Duct Accessories: Backdraft dampers.

F. Section 26 27 17 - Equipment Wiring: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings; American Bearing Manufacturers Association, Inc.; 2015.

B. AMCA 99 - Standards Handbook; Air Movement and Control Association International, Inc.; 2010.

C. AMCA 210 - Laboratory Methods of Testing Fans for Aerodynamic Performance Rating; Air Movement and Control Association International, Inc.; 2007 (ANSI/AMCA 210, same as ANSI/ASHRAE 51).

D. AMCA (DIR) - [Directory of] Products Licensed Under AMCA International Certified Ratings Program; Air Movement and Control Association International, Inc.; http://www.amca.org/certified/search/company.aspx.

E. AMCA 300 - Reverberant Room Method for Sound Testing of Fans; Air Movement and Control Association International, Inc.; 2008.

F. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data; Air Movement and Control Association International, Inc.; 2007.

G. NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association; 2014.

H. SMACNA (DCS) - HVAC Duct Construction Standards; 2005.

1.04 PERFORMANCE REQUIREMENTS

A. Performance Ratings: Determined in accordance with AMCA 210 and bearing the AMCA Certified Rating Seal.

B. Sound Ratings: AMCA 301, tested to AMCA 300, and bear AMCA Certified Sound Rating Seal.

C. Fabrication: Conform to AMCA 99.

D. Performance Base: Sea level conditions.

E. Temperature Limit: Maximum 300 degrees F.

F. Static and Dynamic Balance: Eliminate vibration or noise transmission to occupied areas.

G. Air Flow: 20,000 cfm.

H. Static Pressure: 1 inches.

I. Motor: 5 hp.

1. 460 volts, single phase, 60 Hz.
2. Refer to Section 26 27 17.
3. Type: Open drip proof.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on centrifugal fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels for both fan inlet and outlet at rated capacity, and electrical characteristics and connection requirements.

C. Manufacturer's Instructions: Include complete installation instructions.

D. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect motors, shafts, and bearings from weather and construction dust.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Twin City Fan; Model BAE SWSI 445: www.tcf.com.

B. ACME Engineering and Manufacturing Corporation; _____: www.acmefan.com.

C. Loren Cook Company; _____: www.lorencook.com.

D. PennBarry; _____: www.pennbarry.com.

2.02 WHEEL AND INLET

A. Airfoil Wheel: High efficiency, non-overloading airfoil wheel shall have precision spun, flat inlet cones. Steel construction, hollow airfoil shaped blades continuously welded around all edges; Wheel shall be statically and dynamically balanced on precision electronic balancers to a Balance Quality Grade G6.3 per ANSI/AMCA 204, or better.

2.03 HOUSING

A. Heavy gage steel, continously welded , with rigid bracing. Caulk between intermitent welds to prevent bleed-through corrosion. Designed to minimize turbulence precisely positioned cutoff plates and aerodynamically spun inlet cones.

B. Factory finish before assembly to manufacturer's standard. For fans handling air downstream of humidifiers, provide two additional coats of paint. Prime coating on aluminum parts is not required.

2.04 BEARINGS AND DRIVES

A. Bearings: Heavy duty pillow block type, selfgreasing ball bearings, with ABMA STD 9 life at 50,000 hours.

B. Shafts: Hot rolled steel, ground and polished, with keyway, protectively coated with lubricating oil, and shaft guard.

C. Shaft Seal: Non-asbestos woven fibrous material comperessed between an alauminim cover plate and fan housing.

D. Drive: Cast iron or steel sheaves, dynamically balanced, keyed. Variable and adjustable pitch sheaves for motors 15 hp and under, selected so required rpm is obtained with sheaves set at mid Fixed sheave for 20 hp and over, matched belts, and drive rated as recommended by manufacturer or minimum 1.5 times nameplate rating of the motor.

2.05 ACCESSORIES

A. Outlet Screens: Galvanized steel welded grid.

B. Access Doors: Shaped to conform to scroll, with quick opening latches and gaskets.

C. Scroll Drain: 1/2 inch steel pipe coupling welded to low point of fan scroll.

D. Weather Cover: Easily removable and provides complete protection for the motor, fan bearings, abd V-belt drive; meets OSHA requirements.

E. Mounting: Fan, motor, and drive shall be mounted on a heavy structural base designed for use with spring type vibration isolators. Assembly shall be configures in a space efficient, compact design; Mount motor to adjustable base inside bearing pedestal.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Insall fans with resilient mountings and flexible electrical leads. Refer to Section 23 05 49.

C. Install flexible connections between fan and inlet ductwork; refer to Section 23 33 00. Ensure metal bands of connectors are parallel with minimum one inch flex between ductwork and fan while running.

D. Provide safety screen where inlet or outlet is exposed.

3.02 SCHEDULES

END OF SECTION

SECTION 23 36 00
AIR TERMINAL UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Constant volume terminal units.

B. Variable volume terminal units.

C. Integral heating coils.

1.02 RELATED REQUIREMENTS

A. Section 22 05 48 - Vibration and Seismic Controls for Plumbing Piping and Equipment.

B. Section 23 05 13 - Common Motor Requirements for HVAC Equipment.

C. Section 23 31 00 - HVAC Ducts and Casings.

D. Section 23 33 00 - Air Duct Accessories.

E. Section 23 37 00 - Air Outlets and Inlets.

F. Section 23 09 13 - Instrumentation and Control Devices for HVAC: Thermostats and Actuators.

G. Section 26 27 17 - Equipment Wiring: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. ASTM A492 - Standard Specification for Stainless Steel Rope Wire; 1995.

B. ASTM A603 - Standard Specification for Zinc-Coated Steel Structural Wire Rope; 1998 (Reapproved 2009).

C. SMACNA 1981 - Seismic Duct Restraint Manual; Sheet Metal and Air Conditioning Contractors' National Association; 2008.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data indicating configuration, general assembly, and materials used in fabrication. Include catalog performance ratings that indicate air flow, static pressure, and NC designation. Include electrical characteristics and connection requirements.

C. Manufacturer's Installation Instructions: Indicate support and hanging details, installation instructions, recommendations, and service clearances required.

D. Project Record Documents: Record actual locations of units and locations of access doors required for access of valving.

E. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts lists. Include directions for resetting constant volume regulators.

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

G. Seismic Restraints: Manufacturer to provide seismic restraints and supporting calculations by a P.E. licensed in the state of installation and in accordance with Section 23 05 49.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Titus DESV. www.titus-hvac.com

B. Other acceptable manufacturers offering equivalent products.
   1. Krueger .
   2. Carnes .
   3. Price .
   4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 MANUFACTURED UNITS

A. Ceiling mounted variable air volume supply air control terminals for connection to single duct, central air systems, with electronic variable volume controls, (furnished by DDC contractor and installed in field), electric heating coils.

B. Identify each terminal unit with clearly marked identification label and air flow indicator. Include unit nominal air flow, maximum factory set airflow, minimum factory set air flow, and coil type.

2.03 SINGLE DUCT VARIABLE VOLUME UNITS

A. Furnish and insall single duct, variable air volume terminals of the sizes and capacities shown on the plans.

B. Basic Assembly:
   1. Casings: Minimum 22 gage, 0.0299 inch galvanized steel. Constructed to minimize leakage.
   2. Internal Lining: Minimum 1/2 inch thick foil faced natural fiber insulation which complies with ASTM C 739 and NFPA 90A. The liner shall comply with ASTM G21 and G22 for fungi and bacterial resistance. All exposed edges shal be coated with NFPA approved sealant to prevent entrainment fo fibers in the airstream.
   3. Plenum Air Inlets: Round stub connections for duct attachment.
   4. Plenum Air Outlets: Slip and drive connections for attachement to metal ductwork.

C. Basic Unit:
   1. Configuration: Air volume damper assembly inside unit casing. Locate control components inside protective metal shroud.
   2. Volume Damper: Construct of galvanized steel with peripheral gasket and self lubricating bearings; maximum damper leakage: 2 percent of design air flow at 1 inches rated inlet static pressure.
   3. Mount damper operator to position damper normally open. Shaft shall be clearly marked on the end to indicate damper position. Stickers or other removable markings are not acceptable. The damper shall incorporate a mechanical positive stop to prevent overstroking and a synthetic seal to limit close-off leakage.
   4. Construction: 1/2 inch copper tube mechanically expanded into aluminum plate fins, leak tested under water to 200 psig pressure, factory installed.
   5. Capacity: Based on 120 degree F entering water, 100 degree F leaving water and 50 percent total air volume.

D. Electric Heating Coil:
   1. Construction: Proportional, modulating electric coils shall be supplied and installed the terminal by the terminal manufacturer. Coils shal be UL listed.
   2. Electric Coils shall contain a primary automatic reset termal cutout, a secondary manual reset thermal cutout, proportional electric airflow sensor for proof of flow, and line terminal block. The proportional electronic airflow sensor shall be totally indepenendent of the duct static pressure and shall adjust the heater capacity according to the available airflow. The heaters shall deliver maximum heating when needed with normal minimum airflow, reduce heating with lower than minimum airflow, and stop heating with no airflow.
   3. Heaters shall be equipped with a proportional SCR controller to modulat the heater load according to the temperatre control signal. The electronic controler shall be compatible with the following input signals:
      a. Variable voltage signal 0-10 VDC
      b. Pulse width modulation AC or DC
   4. Electrical Characteristics:

a. 0 - 5 kW.
b. 277 volts, single phase, 60 Hz.
c. > 5 kW.
d. 480 volts, three phase, 60 Hz.
e. Refer to Section 26 27 17.

E. Automatic Damper Operator:
1. Electric Actuator: 24 volt with remote temperature read and reset capability.
2. Actuators shall be capable of supplying at least 35 inch-lbs of torque to the damper shaft and shall be mounted externally for service access.

F. Thermostat: Wall-mounted electric type with appropriate mounting hardware. Refer to Section 23 09 13.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide ceiling access doors or locate units above easily removable ceiling components.

C. Support units individually from structure with wire rope complying with ASTM A492 and ASTM A603 in accordance with SMACNA 1981. See Section 22 05 48.

D. Do not support from ductwork.

E. Connect to ductwork in accordance with Section 23 31 00.

F. Verify that electric power is available and of the correct characteristics.

3.02 SCHEDULES

A. Fan-Powered Air Terminal Unit:
1. Drawing Code: M800
2. Type: Parallel
3. Location: Ceiling
4. Manufacturer: _____
5. Model Number: _____
6. Size: _____ inch
7. Primary Air:
a. Max. Air Flow: _____ CFM
b. Min. Inlet Static Pressure: _____ Inches WG
c. Min. discharge Static Pressure: _____ Inches WG
8. Fan Air:
a. Max. Air Flow: _____ CFM
b. Min. Inlet Static Pressure: _____ Inches WG
c. Min. discharge Static Pressure: _____ Inches WG
9. Unit Air:
10. Max. Primary Air Flow: _____ CFM
11. Min. Inlet Static Pressure: _____ Inches WG
12. Min. Discharge Static Pressure: _____ Inches Wg
13. Hot Water Heat:
a. Min. Air Heat Output: _____ MBH
b. Entering Air Temperature: _____ degrees F
c. Leaving Air Temperature: _____ degrees F
d. Entering Water temperature: _____ degrees F
e. Leaving Water Temperature: _____ degrees F
14. Electric Heat:
a. Input: _____ KW
b. Amps: _____ mA
c. Stages: _____

15. Fan Motor:
    a. Horsepower _____
    b. Type: ECM.
    c. Enclosure: _____
    d. Voltage: _____
    e. Phase: _____
    f. Hertz: _____

B. Sound Power Radiated: dB at _____ inch Schedules Static Pressure

C. Sound Power Discharged: dB at _____ inch Schedules Static Pressure

END OF SECTION

SECTION 23 37 00
AIR OUTLETS AND INLETS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Diffusers.

B. Registers/grilles.

C. Louvers.

1.02 REFERENCE STANDARDS

A. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating; Air Movement and Control Association International, Inc.; 2012.

B. ASHRAE Std 70 - Method of Testing the Performance of Air Outlets and Inlets; American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc.; 2006 (R2011).

1.03 SUBMITTALS

A. See Section 01 3300 - Submittal Procedures, for submittal procedures.

B. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

1.04 QUALITY ASSURANCE

A. Test and rate air outlet and inlet performance in accordance with ASHRAE Std 70.

B. Test and rate louver performance in accordance with AMCA 500-L.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Titus, as scheduled, Price, Krueger, Carnes, Tuttle and Bailey or approved.

B. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 RECTANGULAR CEILING DIFFUSERS

A. Type: Provide square, stamped, multi-core, square, adjustable pattern,stamped, multi-core, square and rectangular, multi-louvered, square and rectangular, adjustable pattern, multi-louvered, and _____ diffuser to discharge air in 360 degree, one way, two way, three way, four way, and _____ pattern with sectorizing baffles where indicated.

B. Connections: Round.

C. Frame: Provide surface mount, snap-in, inverted T-bar, spline, and _____ type. In plaster ceilings, provide plaster frame and ceiling frame.

D. Fabrication: Steel with baked enamel finish.

E. Color: As selected by Architect from manufacturer's standard range.

2.03 CEILING EXHAUST AND RETURN REGISTERS/GRILLES

A. Fabrication: Steel with 20 gage minimum frames and 22 gage minimum blades, steel and aluminum with 20 gage minimum frame, or aluminum extrusions, with factory off-white enamel finish, color to be selected.

2.04 DIFFUSERS AND GRILLES

A. Acceptable Manufacturer:
   1. Price, as scheduled, Titus, Krueger, Metal-Aire, Tuttle and Bailey
   2. Substitutions: See Section 01 6000 - Product Requirements.

B. Ceiling Diffusers and Grilles: Type as scheduled.
   1. Frame: Mounting type as required to suit ceiling type, or duct mounted.
   2. Fabrication: Steel or aluminum, as scheduled.

3. Finish: Provide with white finished coat except where indicated.

C. Return and Exhaust Grilles: Type as scheduled.
   1. Frame: One inch margin with countersunk screw mounting and gasket.
   2. Fabrication: Steel or aluminum, as scheduled.
   3. Finish: Provide with white finished coat except where indicated on Drawings.

2.05 LOUVERS

A. Manufacturer: Ruskin Model ELF375DX, Cesco, Greenheck, or approved.

B. Fabrication:
   1. Performance Ratings: AMCA licensed.
   2. Frame:
      a. Material: Extruded aluminum, Alloy 6063-T5.
      b. Wall Thickness: 0.081 inch, nominal.
      c. Depth: 4 inches.
      d. Downspouts and caulking surfaces.
   3. Blades:
      a. Style: Drainable.
      b. Material: Extruded aluminum, Alloy 6063-T5.
      c. Wall Thickness: 0.081 inch, nominal.
      d. Angle: 37.5 degrees.
      e. Centers: 5-3/32 inches, nominal.
   4. Bird Screen:
      a. Material: Aluminum, 3/4 inch x 0.051 inch expanded, flattened.
      b. Frame: Removable, rewireable.
   5. Gutters: Drain gutter in head frame and each blade.
   6. Downspouts: Downspouts in jambs to drain water from louver for minimum water cascade from blade to blade.
   7. Vertical Supports: Hidden vertical supports to allow continuous line appearance up to 120 inches.
   8. Sill: Steeply angled integral sill eliminating areas of standing or trapped moisture where mold or mildew may thrive and effect indoor air quality.
   9. Assembly: Factory assemble louver components. All welded construction.

C. Performance Data:
   1. Based on testing 48 inch x 48 inch size unit in accordance with AMCA 500.
   2. Free Area: 54 percent, nominal.
   3. Free Area Size: 8.58 square feet.
   4. Maximum Recommended Air Flow Thru Free Area: 873 feet per minute
   5. Air Flow: 7,490 cubic feet per minute.
   6. Maximum Pressure Drop: 0.15 inches w.g.
   7. Water Penetration: Maximum of 0.01 ounces per square foot of free area at an air flow of 873 feet per minute free area velocity when tested for 15 minutes.

D. Aluminum Finish: Color per architect/Owner.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement.

C. Install diffusers to ductwork with air tight connection.

D. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly.

E. Paint ductwork visible behind air outlets and inlets matte black. Refer to Section 09 9100.

3.02 SCHEDULES

3.03 AIR OUTLET AND INLET SCHEDULE

A. Drawing Code:

END OF SECTION

SECTION 23 38 13
COMMERCIAL-KITCHEN HOODS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cooking hoods.

1.02 RELATED REQUIREMENTS

A. Section 10 44 00 - Fire Protection Specialties: Hand held fire extinguishers.

B. Section 11 40 00 - Foodservice Equipment: General provisions for hoods.

C. Section 11 40 01 - Custom Fabricated Foodservice Equipment.

D. Section 21 13 00 - Fire Suppression Sprinklers: Connection of hood fire extinguishing system to sprinkler system.

E. Section 22 10 06 - Plumbing Piping Specialties: Floor drains for indirect discharge.

F. Section 23 31 00 - HVAC Ducts and Casings: Exhaust and make-up air ducts.

G. Section 23 34 16 - Centrifugal HVAC Fans: Kitchen exhaust fans.

H. Section 26 27 17 - Equipment Wiring: Connections to building power system.

I. Section 28 31 00 - Fire Detection and Alarm: Connection of hood fire extinguishing system and fire dampers to building fire alarm system.

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. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; 2014.

C. SMACNA (KVS) - Kitchen Ventilation Systems and Food Service Equipment Fabrication and Installation Guidelines; 2001.

D. UL 710 - Standard for Safety for Exhaust Hoods for Commercial Cooking Equipment; Current Edition, Including All Revisions.

E. UL 1046 - Standard for Grease Filters for Exhaust Ducts; Current Edition, Including All Revisions.

PART 2 PRODUCTS

2.01 HOOD APPLICATIONS

A. Canopy-Style Cooking Hoods Type I:
   1. Style: Wall-attached canopy.
   2. Type: Grease filter type.
   3. Mounting Height: Bottom rim at ____ inches above finished floor.

2.02 HOOD CONSTRUCTION

A. Provide products that comply with NFPA 96, the requirements and recommendations of SMACNA (KVS), and the requirements of the authorities having jurisdiction.

B. Cooking Hoods: Provide Type I hoods, with all external joints and seams continuously welded, liquid-tight, and all internal joints, seams, and attachments sealed liquid-tight and grease-tight.
   1. Provide fire extinguishing system for all cooking hoods.
   2. Provide complete assemblies listed and labeled by UL under UL 710 for its intended use.

C. Construction: Materials, inside and out, are stainless steel complying with ASTM A666, Type 304, stretcher leveled; unless otherwise indicated.
   1. Sheet Thickness: 18 gage, 0.048 inch, minimum.

2. Fabrication: Fabricate each individual hood in one piece, with all welds ground and finished to match (inside and out); fabricate flat surfaces exposed to view as double-pan formed panels with internal stiffener members.
3. Finish on Surfaces Exposed to View: No.4 (brushed directional); provide stainless steel faces on all sides exposed to view.
4. Finish on Concealed Surfaces: No.4 or No.2B (dull, matte).
5. Duct Collars: For exhaust and make-up air openings, provide duct collar welded to hood unit; minimum of 8 inches extension from top or back face of unit, with minimum one inch 90 degree flange, unless otherwise indicated.
6. Access Panels: Provide removable or hinged access panels sufficient for maintenance and replacement of operating components inside unit; maximum width of 40 inches.
7. Supports: Stainless steel mounting brackets, struts, and threaded hanger rods.
   a. Hanger Rods: 3/8 inch diameter, minimum.
   b. Hanger Spacing: 48 inches on center, maximum.
   c. Attachment to Structure: Mechanical fittings or inserts, stainless steel.

2.03 HOOD ACCESSORIES

A. Fire Extinguishing System: Comply with NFPA 96.
   1. Type: Liquid foam type.
   2. Exposed Piping Under Hood: Stainless steel or chrome plated.
   3. Exposed Piping Outside Hood: Not permitted.
   4. Nozzles: Stainless steel or chrome plated brass.
   5. Electrical Components: Provide all components required for properly operating system, including but not limited to wiring, raceways, contactors, circuit breakers, switches and solenoids.
   6. Fire Alarm System: Provide connection point for building fire alarm system capable of signaling system readiness and to generate signal when system is actuated.
   7. Manual Actuators: Wall-mounted pull stations; provide one near each hood and one near exit door.

B. Controls:
   1. Fans: Provide manual push button controls for starting and stopping fans and labeled indicator lights showing fan status.
   2. Fans: Provide controls for fan operation by time clock, programmable by the week, capable of maintaining time cycle after operation of manual push buttons.
   3. Cooking Equipment: Provide manual shutoff and reset button located where indicated; combine with fire extinguishing actuation.
   4. Fire Extinguishing System: Provide automatic actuation complying with NFPA 96; provide local and remote manual actuating stations clearly labeled "Hood Fire Protection"; upon actuation of fire extinguishing system, automatically:
      a. Shut off fans serving that hood.
      b. Shut off fuel source to equipment under hood; actuate solenoid gas valves provided as part of gas piping work.
      c. Shut off electric power to equipment under hood; actuate contactors or switches provided as part of electrical work.
      d. Signal building fire alarm system; normally-open contacts.

C. Control Panels: Factory assembled and pre-wired, ready for utility connections.
   1. UL listed for use with specific hood.
   2. Provide a single control panel combining all control functions for a particular hood, unless otherwise indicated.
   3. Provide a single control panel for each group of hoods served by a single exhaust fan.
   4. Enclosures: Flush-mounted; stainless steel, to match hood.
   5. Provide indicator lights on control panel door showing status of fans and power supply.

D. Grease Filters: Stainless steel, washable, complying with UL 1046, UL listed and labeled;

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that overhead supports are installed in correct locations.

B. Do not begin installation until substrates have been properly prepared.

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

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions and NFPA 96.

B. Install hoods level and plumb, securely fastened, with seismic restraints as specified, and free of vibration during normal operation.

C. Weld hood duct collars to ductwork, liquid-tight.

D. Connect to utilities.

3.03 SYSTEM STARTUP

A. Obtain the services of the manufacturer's representative experienced in the installation, adjustment, and operation of the equipment to supervise the starting and adjusting of equipment.

B. Prepare equipment for startup, start and operate equipment for sufficient period to verify proper operation; correct equipment not operating correctly.

C. Adjust volume dampers as required for proper air flow after building air handling systems have been balanced and adjusted.

D. Demonstrate operation to Owner's designated personnel.

E. Report deficiencies in writing to Architect.

3.04 CLOSEOUT ACTIVITIES

A. Conduct training of Owner's designated personnel in the operation and maintenance of equipment.

B. Perform at least 2 hours of training, for minimum of 2 people, at project site.

C. Arrange training sessions with Owner at least 2 weeks in advance.

D. Have operation and maintenance data on hand for training sessions.

END OF SECTION

SECTION 23 73 13

MODULAR CENTRAL-STATION AIR-HANDLING UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Roof mounting curb.

B. Modify sections and components of the existing air handling unit, including outside air dampers, coil drain pan, damper removal, fan flexible duct connection, and fan motor-drive modifications

1.02 RELATED REQUIREMENTS

A. Drawings: M701 and M702 Mechanical Details.

B. Section 23 05 13 - Common Motor Requirements for HVAC Equipment.

C. Section 23 05 49 - Vibration and Seismic Controls for HVAC Piping and Equipment.

D. Section 23 07 19 - HVAC Piping Insulation.

E. Section 23 33 00 - Air Duct Accessories: Flexible duct connections.

F. Section 23 34 16 - Centrifugal HVAC Fans.

G. Section 23 82 00 - Convection Heating and Cooling Units: Air Coils.

H. Section 26 27 17 - Equipment Wiring: Electrical characteristics and wiring connections.

I. Section 26 - Common Motor Requirements

1.03 REFERENCE STANDARDS

A. AHRI 260 - Sound Rating of Ducted Air Moving and Conditioning Equipment; 2011.

B. AHRI 410 - Standard for Forced-Circulation Air-Cooling and Air-Heating Coils; Air-Conditioning, Heating, and Refrigeration Institute; 2001 (R2011).

C. AHRI 430 (I-P) - Standard for Central-Station Air-Handling Units; Air-Conditioning, Heating, and Refrigeration Institute; 2014.

D. AMCA 500-D - Laboratory Methods of Testing Dampers for Rating; 2012.

E. ASHRAE Std 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings; 2013, Including All Addenda (ANSI/ASHRAE/IES Std 90.1).

F. ASTM E477 - Standard Test Method for Measuring Acoustical and Airflow Performance of Duct Liner Materials and Prefabricated Silencers; 2013.

G. SMACNA (DCS) - HVAC Duct Construction Standards; Sheet Metal and Air Conditioning Contractors' National Association; 2005.

H. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; Current edition, including all revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the installation of component modifications including: new fan motor and variable frequency drive that will be furnished and installed by Division 26. Insure access for controls subcontractor and testing and balancing contractor. with size, location and installation of service utilities.

B. Coordinate the work with other trades for installation of roof mounted air handling units on roof curbs.

C. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

D. Sequencing: Ensure that electrical connections are achieved in an orderly and expeditious manner. Coordinate shut-down of air handling unit and work shifts to maintain air service when building is occupied.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

1.06 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Accept products on site in factory-fabricated protective containers. Inspect for damage.

B. Store in clean dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures, and finish.

C. Do not operate units until ductwork is clean, filters are in place, bearings lubricated, and fan and motor have been test run under observation.

PART 2 PRODUCTS

2.01 COIL & DRAIN PAN

A. Drain Pan: 18 inch downstream of coil. 20 gauge galvanized steel.

B. Joints: Liquid & waterproof sealant. [] or equivalent.

C. Eliminators: Three break of galvanized steel, mounted over drain pan.

2.02 BYPASS ZONE DAMPERS AND BLANK-OFF PLATE

A. Remove zone dampers and install sheet metal blank-off plats. 20 gauge galvanized steel.

2.03 FILTER AND AIR CLEANER SECTION

A. General: Provide new filters upon initiation of work and upon start-up of modified air handlins unit.

B. Hi-Efficiency Filters:
   1. Media: 2 inch closely spaced, pleated, fine fiber, hi-efficiency filter. MERV 13.

2.04 LOW LEAK DAMPERS

A. _____ Sections: Provide functional sections to support the damper assembly for modulating the volume of outdoor air, with a separate section for minimum ventilation function.

B. Damper Blades:
   1. Double-skin airfoil design with metal, compressible jamb seals and extruded-vinyl blade-edge seals on all blades.
   2. Self-lubricating stainless steel or synthetic sleeve bearings.
   3. Comply with ASHRAE 90.1 for rated maximum leakage rate.
   4. Base all leakage testing and pressure ratings on AMCA 500-D.
   5. Arrange in opposed-blade configuration per details in drawings.

C. Frame: _____.

2.05 ROOF MOUNTING CURB

A. Roof Vibration Isolation Mounting Curb: 14 inches high galvanized steel, channel frame with gaskets and nailer strips.

B. Include roof curb accessories for each roof mounted unit.

2.06 FILTERS

2.07 DAMPERS

PART 3 EXECUTION

3.01 GENERAL

A. Execute all modifications in a neat and workmanlike manner. Grind rough surfaces to achieve smooth, clean, and safe edges and surfaces. Comply with deails in drawings.

3.02 CLEANING

A. Fans: Clean fan wheel and housing. Remove all accumulated dirt, grease and grime from blades and housing. Prepare discharge for new flex duct connection.

END OF SECTION

SECTION 26 01 00
GENERAL ELECTRICAL PROVISIONS

PART 1 - GENERAL

1.01 CONTRACT CONDITIONS

A. Work of this Section is bound by General Conditions, Supplementary Conditions, and Division 1 bound herewith in addition to this Specification and accompanying Drawings.

B. The Drawings and Specifications are complimentary and what is called for by one shall be as binding as if called for by both.

C. The Contractor shall inspect the job site prior to proposing and become familiarized with existing conditions which will affect the work.

D. Prior to start of work, obtain "As built," "Record," or other Drawings showing existing conditions or underground utilities.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Comply with requirements herein where other Divisions call for Work under this Division of Specifications. Electrical Work required by other Divisions not shown on Electrical Drawings or specified in this Division of Specification shall be provided by trade or sub-trade requiring Electrical Work.

1.03 DESCRIPTION OF SYSTEM

A. Electrical Drawings are diagrammatic and do not necessarily show all raceways, wiring, number and types of fittings required.

B. Provide all related Electrical Work specified herein and diagrammed or scheduled on Electrical Drawings. All work shall conform to applicable national, state, and local codes. Contractor is responsible for installation of complete and operating electrical systems.

C. Where any device or part of equipment is referred to in these specifications in the singular number (such as "the switch"), such reference shall be deemed to apply to as many such devices as are required to complete the installation as shown on the drawings.

1.04 QUALITY ASSURANCE

A. Qualifications of Installers
   1. For actual fabrication, installation and testing of Work of this Section, use only thoroughly trained and experienced personnel familiar with requirements for this Work and with installation recommendations of Manufacturers of specified items.

B. Design Criteria:
   1. Conform Work with conditions shown and specified.
   2. Where adjustments or modifications of Work are necessary for fabrication and installation of items, or for resolution of conflicts between items, make such adjustments at no added expense to Owner.
   3. Submit adjustments or modifications of Work affecting functional or aesthetic design of Work to Architect for review.
   4. Pay for equipment relocations or modifications necessitated by failure to advise Architect of conflicts or coordinate work.

C. Select equipment to meet design conditions stated. Contractor is responsible for meeting technical data and performance requirements of system.

D. Satisfy requirements of regulatory agencies or codes having jurisdiction over project. Provide U.L. labels for all equipment falling under testing capabilities of U.L.

E. Procure licenses and permits, and pay fees, deposits, assessments and tax charges required for Electrical Work.

F. Arrange for and pay for inspections and tests required by codes and ordinances during construction.

1.05 REFERENCE STANDARDS

A. The following specifications and standards, except as hereinafter modified, are incorporated herein by reference and from a part of this specification to the extent indicated by the references thereto. Except where a specific date is given, the issue in effect (including amendments, addenda, revisions, supplements, and errata) on the date of Invitation for Proposals shall be applicable. In text such specifications and standards are referred to by basic designation only.
   1. Underwriters Laboratories (UL).
   2. National Fire Protection Association (NFPA), Specifically:
      a. NFPA 70 - National Electric Code.
      b. NFPA 72 - National Fire Alarm Code.
      c. NFPA 101 - Life Safety Code.
      d. NFPA 90A - Installation of Air Conditioning and Ventilating Systems.
      e. NFPA 56A - Standards for Use of Inhalation Anesthetics.
   3. International Mechanical Code (IMC) with State of Oregon Amendments.
   4. International Building Code (IBC) with State of Oregon Amendments.
   5. International Fire Code (IFC) with State of Oregon Amendments.
   6. National Electrical Manufacturer's Association (NEMA).
   7. American National Standards Institute (ANSI).
   8. National Electrical Testing Associations (NETA).
   9. Occupational Safety and Health Administration (OSHA).
   10. City, County, and State Codes and Ordinances.

1.06 SUBMITTALS

A. Provide shop drawings and product data for the Work of this Division in accordance with Division 1 Section 01 3300.

B. Submittal material sent by facsimile machine will not be accepted.

C. Post Contract Award:
   1. Prepare and submit as follows:
      a. Provide complete drawings, diagrams, illustrations, performance charts, brochures, and/or other data which adequately describes product to enable thorough evaluation.
      b. Number of copies, method of distribution, format and schedule for submission; per Supplementary Conditions or Division 1.
      c. Submit all at one time.
      d. Use 3-ring loose leaf binders for submittals with index referenced to Specification section and page. Tab individual sections.
      e. Review and correct submittal information with stamped approval prior to forwarding to Architect.
      f. Do not order or manufacture equipment until full review received from Architect and/or Engineer.
      g. Submit, where applicable, certificates denoting conformance to standards adopted by recognized organizations such as NEMA, UL, OSHA, etc.

D. Review statements and submittals prepared by the Contractor will be evaluated by the Engineer, and one of the following statements will be affixed to the submittal material.
   1. "No Exception Taken" The meaning and intent of this statement is that the Engineer finds no objection (except those noted thereon or in correspondence) to inclusion of items or Work indicated in construction provided that it:
      a. Complies with Contract Drawings and Specifications as to quantities, space requirements, and dimensions.
      b. Does not interfere with other trades.
      c. Is not the cause of union tradesmen disputes.
      d. Does not infringe on patent rights.
      e. Is not the cause of injury or damage to persons or property.
      f. Complies with OSHA regulations.

2. "Rejected" The meaning and intent of this statement is that the submitted material does not conform to plans and specifications. Resubmittal of a different product or shop drawing is required.
3. "Revise and Resubmit" This statement is used when the general product line is acceptable, but the submitted material varies in dimension, accessories, etc. from what is required. Resubmittal is required.
4. "Make Corrections Noted" This statement is used as an alternative to "Revise and Resubmit" when resubmittal is not required.
5. Said review does not relieve Contractor of any Contractual responsibilities.

E. Provide product data for materials and equipment as required by individual sections.

F. Provide Shop Drawings for materials and equipment as required by individual sections.

1.07 SUBSTITUTIONS

A. Substitution requests will not be considered unless they are submitted in writing, in accordance with Instructions to Proposers, Supplementary Instructions to Proposers, and Section 01 60 00.

B. Products specified herein are so specified to establish a minimum level of product quality. Except where indicated that no substitutions are allowable, equivalent quality products may be submitted to the Architect for approval.

C. Substitution requests will not be considered unless they include the following:
1. Model numbers of proposed substitutions.
2. Options which are required to make the proposed substitution comply with Specifications.
3. Summary of modifications of the Work which are required to accommodate the proposed substitution.

1.08 OPERATION AND MAINTENANCE MANUALS, INSTRUCTION AND TRAINING

A. Manual:
1. Provide in accordance with Division 1 Section 01 7700. Scope: Following installation of electrical equipment, and prior to acceptance of Electrical Work, prepare manuals describing operations, servicing, and maintenance requirements of electrical equipment and systems installed.
2. Equipment described in manual:
   a. Equipment listed under "Submittals."
   b. Other auxiliary miscellaneous systems.
3. Information contained in manual:
   a. Catalog data on each item including complete parts lists, catalog numbers, maintenance information and wiring diagrams.
   b. Service organizations for equipment.
   c. Manufacturer's recommended servicing instructions.
   d. Diagrams complete for each system installed.
4. Presentation:
   a. Provide information on neat, clean 8-1/2 inch x 11 inch sheets.
   b. Provide drawings, accordion folded to letter size.
   c. Divide manual into chapters which follow section sequence of Specifications of this Division.
5. Cover:
   a. Enclose each manual in hardboard post-type binder.
   b. Imprint front of binder with following:
      1) "Electrical Equipment."
      2) Name of Owner.
      3) Year completed.
      4) Names of Architect, Engineer and Contractor.
   c. Imprint outside end cover of binder with following:
      1) "Electrical Equipment."
      2) Name of building.

3) Name of Owner.
4) Year of completion of building.

B. Instruction and Training:
1. Contractor responsibilities:
a. Train Owner personnel in operation and maintenance of all installed electrical equipment and systems.
b. Submit proposed scope of training materials and instruction schedule to Architect for review and approval 30 days prior to scheduled completion of building.
c. Arrange mutually agreeable dates for training with Owner.
d. Include classroom and on-the-job instruction by qualified installation and maintenance personnel.

1.09 RECORD DRAWINGS

A. Provide in accordance with Division 1.

1.10 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Make inspection of equipment for possible damage at time of delivery to avoid future delays in construction due to replacement or repair.

B. Protect against damage, theft and deterioration.
1. Store in original factory containers.
2. Do not expose equipment to dust, powder, abrasive, wetness, excessive dampness or temperature extremes, unless equipment approved for that use.

C. In event of damage, immediately make all repairs and/or replacements necessary to approval of Architect, at no additional expense to Owner.

1.11 PROTECTION

A. Suitably protect any unfinished Work from potential physical damage.

B. Do not leave unfinished Work unattended, which would pose life safety hazard.

C. Protect other Work against damage and discoloration caused by Work of this Section.

1.12 COORDINATION

A. Provide coordination for the Work of this Division in accordance with Division 1 Section 01 31 00.

B. Report any discrepancies discovered between existing job conditions and Work to be installed. Fully resolve such discrepancies prior to continuation of work.

C. Coordinate sequencing of equipment installation and energizing with other trades.

D. Consult Architect prior to installing equipment in area which obviously exceeds, or will exceed, ambient operating requirements such as for temperature and humidity.

1.13 ALTERNATIVES AND ALLOWANCES

A. Refer to Proposal Form and Sections 01 21 00 and 01 23 00 for possible effect upon Work of this Section.

1.14 WARRANTY

A. Warrant all Work included in this Specification for period of one year from date of substantial completion, under provisions of Section 01 70 00.

B. During warranty period, remedy without delay or expense to Owner any defects providing, in judgment of Engineer, that such defects are not result of misuse or abuse on part of Owner.

C. Warrant that all equipment and installations are in compliance with OSHA regulations.

1.15 SCHEDULE OF VALUES

A. After award of contract, submit to Engineer a cost breakdown of work. Divide costs into the following categories:
1. Administration.

2. Basic materials and methods.
3. Panelboards and switchgear.
4. Standby Generator and accessories.
5. Lighting fixtures and lighting control equipment.
6. Fire alarm equipment.
7. Telephone and network equipment.
8. Access control equipment.
9. Photovoltaic system.
10. Other.

B. Submit in accordance with provisions of this section.

PART 2 - PRODUCTS

2.01 MATERIAL

A. Provide new material and equipment items that are standard products of Manufacturers regularly engaged in production of such materials and equipment. Architect reserves right to reject items not in accordance with Specifications.

B. For each type of equipment, use same manufacturer throughout.

C. Provide corrosion protection for ferrous metalwork exposed to weather by hot dip galvanizing, or factory painted finish suitable for outdoor installations.

D. Verify all materials are acceptable to Authority having jurisdiction, as suitable for the use intended.

E. All electrical equipment shall be listed for the application.

PART 3 - EXECUTION

3.01 COMPLETION

A. Complete each system as shown or specified herein and place in operation, except where only roughing-in or partial systems are called for.

B. Outlets or equipment shown on the plans, with no supply conduit or conductors indicated, shall be completed in the same methods and manner as similar or like outlets or equipment shown on the drawings.

3.02 SCHEDULING OF WORK

A. Schedule Work with all other Contractors to maintain job progress schedule, and avoid conflicts in installation of Work by various trades.

B. Coordinate with General Contractor to provide adequate access for installing large equipment.

C. Coordinate electrical service changes with local utility.

3.03 EXCAVATION

A. Contact utilities before starting any excavation to locate underground services on site or in adjacent streets.

B. Locate and protect any existing underground services.

C. Repair any services damaged.

3.04 TRENCHING AND BACKFILLING

A. See Division 31.

B. Provide trenching and backfilling to depth required for underground conduit, per NEC and/or Utility requirements, 36 inches minimum.

C. Backfilling prior to inspection of installation by Architect's representative and serving Utility not permitted.

D. Minimum backfill requirements:
1. Raceway runs beneath building slabs, beneath areas to be paved and beneath streets and sidewalks.

a. Use 1/4 inch to 1 inch diameter, crushed or clean round river rock.

2. Underground raceway runs at all other locations.
   a. Backfill in compacted layers not exceeding 6 inches in depth.
   b. Use sand or "clean" earth free from rock larger than 1 inch diameter and debris.
3. Provide one continuous #14 copper conductor as a tracing conductor for locating the conduits in the future. Install the tracing conductor at the center line of the upper-most conduit in the trench. Install one tracing conductor in each conduit trench for each 4-foot trench width and one for each additional trench width of less than 4 feet wide. (i.e., provide one for a trench up to 4-feet wide, two for 5-8 feet wide, three for 9-12 feet wide, etc.). Provide a 6 foot coil of tracing wire at each end of the trench clearly marked on an identification tag: “TRENCH TRACING CONDUCTOR”. Also include the tracing conductor destination and a description of the conduits/conductors in the trench. The identification tag shall be machine generated text, enclosed in a waterproof clear plastic seal, and attached to the coil by means of a tywrap.

E. Trenching and Backfilling for Services:
   1. Coordinate with all utilities for joint trench service Work.
   2. Uncover existing utilities by hand digging only.
   3. Size to accommodate all utility service conduits and accessories.

F. Power digging only in direction away from existing facilities.

G. Route trenching in manner to avoid weakening footings.

H. Restore, to Architect's satisfaction at no additional expense, any sidewalks, landscaping, or other existing structure damaged due to excavation.

3.05 SLEEVES AND OPENINGS

A. Provide through floors and walls for Electrical Work.

B. Coordinate with General Contractor and other trades involved.

C. Patch and seal around all openings, both sides of material penetrated where possible.

3.06 CUTTING AND PATCHING

A. See Division 1.

B. Inform General Contractor of all openings required in building construction for installation of Work.

C. Where access within or behind existing surfaces is required by the work of this Section, remove, cut, patch reinstall, and refinish surfaces and assemblies as required to restore them to their previous and/or scheduled finish condition.

3.07 PAINTING

A. See Division 9 Section 09 90 00.

B. Painting of Electrical Work shall be performed by General Contractor.

C. Painting of Electrical Work not included in Electrical Work, unless otherwise noted on Drawings or specified herein.

D. Coordinate with General Contractor.

3.08 MANUFACTURER'S INSTALLATION DETAILS

A. Follow exactly, where available.

B. Provide special wiring or fittings as required.

3.09 ACCESSIBILITY OF EQUIPMENT

A. Install equipment accessible for operation, maintenance or repair as required by NEC.

B. Inaccessible Equipment:
   1. Where the Owner's representative determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, equipment shall be removed and reinstalled as directed, at no additional cost to the Owner.

2. "Conveniently accessible" is defined as being capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as motors, pumps, belt guards, transformers, piping and ductwork.

3.10 COORDINATION

A. Coordinate all light fixture and device locations with other trades to avoid possible conflicts with ducts, sprinkler piping, and other obstacles affecting installation.

B. Coordinate conduit, junction boxes, supporting equipment, etc. Affecting normal operating and maintenance activities related to mechanical equipment, piping, valves, accessories, etc.

3.11 TESTS

A. Fully test and adjust equipment installed under this specifications prior to Owner's personnel instruction. Each system shall be left in proper operation free of faults, shorts or unintentional grounds.

B. Do not test or operate for any other purpose, such as checking motor rotation, any item of equipment until fully checked in accordance with Manufacturer's instructions.

C. Demonstration held upon completion of all systems at a time agreed upon in writing by the Owner or his representative. Each system demonstrated once only, after completion of testing.

D. Demonstrate functions and location of each system and indicate its relationship to "Riser-Diagrams" on Drawings. Demonstrate by "Start-Stop operation" how to work controls, reset protective devices, replace fuses and procedures for emergency conditions.

E. Submit to engineer certificate of completed demonstration countersigned by Architect.

3.12 CLEANING OF ELECTRICAL INSTALLATION

A. See Division 1 Section 01 70 00.

B. Prior to acceptance of building, thoroughly clean all exposed portions of electrical installation.

C. Remove all nonessential labels and traces of foreign substances.

D. Use only cleaning solution approved by Manufacturer.

E. Avoid any damage to finished surfaces.

3.13 EXTRA STOCK

A. Provide extra stock as described in individual sections to Owner.

3.14 EQUIPMENT CONNECTIONS

A. Provide a complete electrical connection for all items of equipment including incidental wiring, materials, devices and labor necessary for a complete operating system. The location and method for connecting to each item of equipment shall be verified prior to rough-in. The voltage and phase of each item of equipment shall be checked before connecting. Motor rotations shall be made in the proper direction. Pump motors are not to be test run until liquid is in the system and proper lubrication to all bearings in unit is checked.

B. Conduit, wire and circuit breaker sizes for mechanical and similar equipment are based on the equipment ratings of one manufacturer. The equipment actually furnished may have entirely different electrical characteristics. Conduit, wire and circuit breakers shall not be ordered or installed until exact electrical requirements are obtained. Responsibility for this coordination rests with the Contractor.

END OF SECTION

SECTION 26 05 01
MINOR ELECTRICAL DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical demolition.

1.02 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Sustainable Design Documentation: Submit certification of removal and appropriate disposal of abandoned cables containing lead stabilizers.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Materials and equipment for patching and extending work: As specified in individual sections.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify field measurements and circuiting arrangements are as shown on Drawings.

B. Verify that abandoned wiring and equipment serve only abandoned facilities.

C. Demolition drawings are based on casual field observation and existing record documents.

D. Report discrepancies to Architect before disturbing existing installation.

E. Beginning of demolition means installer accepts existing conditions.

3.02 PREPARATION

A. Disconnect electrical systems in walls, floors, and ceilings to be removed.

B. Coordinate utility service outages with utility company.

C. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.

D. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Minimize outage duration.
   1. Obtain permission from Owner at least 24 hours before partially or completely disabling system.
   2. Make temporary connections to maintain service in areas adjacent to work area.

3.03 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. Perform work for removal and disposal of equipment and materials containing toxic substances regulated under the Federal Toxic Substances Control Act (TSCA) in accordance with applicable federal, state, and local regulations. Applicable equipment and materials include, but are not limited to:
   1. PCB- and DEHP-containing lighting ballasts.
   2. Mercury-containing lamps and tubes, including fluorescent lamps, high intensity discharge (HID), arc lamps, ultra-violet, high pressure sodium, mercury vapor, ignitron tubes, neon, and incandescent.

B. Remove, relocate, and extend existing installations to accommodate new construction.

C. Remove abandoned wiring to source of supply.

D. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.

E. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets that are not removed.

F. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.

G. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.

H. Repair adjacent construction and finishes damaged during demolition and extension work.

I. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.

J. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.

3.04 CLEANING AND REPAIR

A. Clean and repair existing materials and equipment that remain or that are to be reused.

B. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.

C. Luminaires: Remove existing luminaires for cleaning. Use mild detergent to clean all exterior and interior surfaces; rinse with clean water and wipe dry. Replace lamps, ballasts and broken electrical parts.

END OF SECTION

SECTION 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Single conductor building wire.

B. Wiring connectors.

C. Electrical tape.

D. Oxide inhibiting compound.

E. Wire pulling lubricant.

1.02 RELATED REQUIREMENTS

A. Section 26 05 01 - Minor Electrical Demolition: Disconnection, removal, and/or extension of existing electrical conductors and cables.

B. Section 26 05 26 - Grounding and Bonding for Electrical Systems: Additional requirements for grounding conductors and grounding connectors.

C. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS

A. ASTM B800 - Standard Specification for 8000 Series Aluminum Alloy Wire for Electrical Purposes - Annealed and Intermediate Tempers; 2005 (Reapproved 2011).

B. ASTM B801 - Standard Specification for Concentric-Lay-Stranded Conductors of 8000 Series Aluminum Alloy Wire for Subsequent Covering of Insulation; 2007 (Reapproved 2012).

C. ASTM D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape; 2010.

D. ASTM D4388 - Standard Specification for Nonmetallic Semi-Conducting and Electrically Insulating Rubber Tapes; 2013.

E. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.

F. NECA 104 - Recommended Practice for Installing Aluminum Building Wire and Cable; National Electrical Contractors Association; 2012 (NECA/AA 104).

G. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; International Electrical Testing Association; 2013 (ANSI/NETA ATS).

H. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
2. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.
3. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conductors and cables, including detailed information on materials, construction, ratings, listings, and available sizes, configurations, and stranding.

C. Project Record Documents: Record actual locations of components and circuits.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Products: Furnish products listed and classified by Underwriters Laboratories Inc. or testing firm acceptable to the authority having jusrisdiction as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 CONDUCTOR AND CABLE APPLICATIONS

A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.

B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.

C. Underground feeder and branch-circuit cable is not permitted.

D. Service entrance cable is not permitted.

E. Armored cable is not permitted.
   1. In addition to other applicable restrictions, may not be used:
      a. Unless approved by Owner.
      b. Where not approved for use by the authority having jurisdiction.
      c. Where exposed to view.
      d. Where exposed to damage.
      e. For damp, wet, or corrosive locations.

F. Metal-clad cable is not permitted.

2.02 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

A. Provide products that comply with requirements of NFPA 70.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Provide new conductors and cables manufactured not more than one year prior to installation.

D. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.

E. Comply with NEMA WC 70.

F. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.

G. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.

H. Conductors for Grounding and Bonding: Also comply with Section 26 05 26.

I. Conductors and Cables Installed Where Exposed to Direct Rays of Sun: Listed and labeled as sunlight resistant.

J. Conductor Material:
   1. Provide copper conductors except where aluminum conductors are specifically indicated or permitted for substitution. Conductor sizes indicated are based on copper unless specifically indicated as aluminum. Conductors designated with the abbreviation "AL" indicate aluminum.
      a. Substitution of aluminum conductors for copper is permitted, when approved by Owner and authority having jurisdiction, only for the following:
         1) Feeders: Copper conductors size 1/0 AWG and larger.

b. Where aluminum conductors are substituted for copper, comply with the following:
1) Size aluminum conductors to provide, when compared to copper sizes indicated, equivalent or greater ampacity and equivalent or less voltage drop.
2) Increase size of raceways, boxes, wiring gutters, enclosures, etc. as required to accommodate aluminum conductors.
3) Provide aluminum equipment grounding conductor sized according to NFPA 70.
4) Equip electrical distribution equipment with compression lugs for terminating aluminum conductors.

2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B 787M unless otherwise indicated.
3. Tinned Copper Conductors: Comply with ASTM B33.
4. Aluminum Conductors (only where specifically indicated or permitted for substitution): AA-8000 series aluminum alloy conductors recognized by ASTM B800 and compact stranded in accordance with ASTM B801 unless otherwise indicated.

K. Conductor Color Coding:
1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
2. Color Coding Method: Integrally colored insulation.
3. Color Code:
a. 480Y/277 V, 3 Phase, 4 Wire System:
1) Phase A: Brown.
2) Phase B: Orange.
3) Phase C: Yellow.
4) Neutral/Grounded: Gray.
b. 208Y/120 V, 3 Phase, 4 Wire System:
1) Phase A: Black.
2) Phase B: Red.
3) Phase C: Blue.
4) Neutral/Grounded: White.
c. Equipment Ground, All Systems: Green.
d. For modifications or additions to existing wiring systems, comply with existing color code when existing code complies with NFPA 70 and is approved by the authority having jurisdiction.
e. For control circuits, comply with manufacturer's recommended color code.

2.03 SINGLE CONDUCTOR BUILDING WIRE

A. Manufacturers:
1. Copper Building Wire:
a. Cerro Wire LLC: www.cerrowire.com.
b. Encore Wire Corporation: www.encorewire.com.
c. Southwire Company: www.southwire.com.
d. Substitutions: See Section 01 60 00 - Product Requirements.
2. Aluminum Building Wire (only where specifically indicated or permitted for substitution):
a. Encore Wire Corporation: www.encorewire.com.
b. Southwire Company: www.southwire.com.
c. Substitutions: See Section 01 60 00 - Product Requirements.

B. Description: Single conductor insulated wire.

C. Conductor Stranding:
1. Feeders and Branch Circuits:
a. Size 10 AWG and Smaller: Solid.
b. Size 8 AWG and Larger: Stranded.
2. Control Circuits: Stranded.

D. Insulation Voltage Rating: 600 V.

E. Insulation:
   1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2, except as indicated below.
      a. Size 4 AWG and Larger: Type XHHW-2.
      b. Installed Underground: Type XHHW-2.
      c. Fixture Wiring Within Luminaires: Type TFFN/TFN for luminaires with labeled maximum temperature of 90 degrees C; Approved suitable type for luminaires with labeled maximum temperature greater than 90 degrees C.
   2. Aluminum Building Wire (only where specifically indicated or permitted for substitution): Type XHHW-2.

2.04 WIRING CONNECTORS

A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.

B. Connectors for Grounding and Bonding: Comply with Section 26 05 26.

C. Compression Connectors: Provide circumferential type or hex type crimp configuration.

D. Crimped Terminals: Nylon-insulated, with insulation grip and terminal configuration suitable for connection to be made.

2.05 WIRING ACCESSORIES

A. Electrical Tape:
   1. Manufacturers:
      a. 3M: www.3m.com.
      b. Plymouth Rubber Europa: www.plymouthrubber.com.
      c. Substitutions: See Section 01 60 00 - Product Requirements.
   2. Vinyl Color Coding Electrical Tape: Integrally colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221 degrees F.
      a. Substitutions: See Section 01 60 00 - Product Requirements.
   3. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F and suitable for continuous temperature environment up to 221 degrees F.
   4. Rubber Splicing Electrical Tape: Ethylene Propylene Rubber (EPR) tape, complying with ASTM D4388; minimum thickness of 30 mil; suitable for continuous temperature environment up to 194 degrees F and short-term 266 degrees F overload service.
   5. Electrical Filler Tape: Rubber-based insulating moldable putty, minimum thickness of 125 mil; suitable for continuous temperature environment up to 176 degrees F.
   6. Varnished Cambric Electrical Tape: Cotton cambric fabric tape, with or without adhesive, oil-primed and coated with high-grade insulating varnish; minimum thickness of 7 mil; suitable for continuous temperature environment up to 221 degrees F.
   7. Moisture Sealing Electrical Tape: Insulating mastic compound laminated to flexible, all-weather vinyl backing; minimum thickness of 90 mil.

B. Oxide Inhibiting Compound: Listed; suitable for use with the conductors or cables to be installed.
   1. Manufacturers:
      a. Burndy: www.burndy.com.
      b. Ideal Industries, Inc: www.idealindustries.com.
      c. Ilsco: www.ilsco.com.

C. Wire Pulling Lubricant: Listed; suitable for use with the conductors or cables to be installed and suitable for use at the installation temperature.
   1. Manufacturers:
      a. 3M: www.3m.com.
      b. American Polywater Corporation: www.polywater.com.

c. Ideal Industries, Inc: www.idealindustries.com.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that interior of building has been protected from weather.

B. Verify that work likely to damage wire and cable has been completed.

C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.

D. Verify that field measurements are as shown on the drawings.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.03 INSTALLATION

A. Circuiting Requirements:
   1. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.
   2. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are shown as separate, combining them together in a single raceway is not permitted.
   3. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among up to three single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.

B. Install products in accordance with manufacturer's instructions.

C. Install conductors and cable in a neat and workmanlike manner in accordance with NECA 1.

D. Install aluminum conductors in accordance with NECA 104.

E. Installation in Raceway:
   1. Pull all conductors and cables together into raceway at same time.
   2. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
   3. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.

F. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.

G. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.
   1. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conductors and cables to lay on ceiling tiles.
   2. Installation in Vertical Raceways: Provide supports where vertical rise exceeds permissible limits.

H. Install conductors with a minimum of 8 inches of slack at each outlet.

I. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.

J. Make wiring connections using specified wiring connectors.
   1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies.
   2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
   3. Do not remove conductor strands to facilitate insertion into connector.

4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminates. Do not use wire brush on plated connector surfaces.
5. Connections for Aluminum Conductors: Fill connectors with oxide inhibiting compound where not pre-filled by manufacturer.
6. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
7. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

K. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.
   1. Dry Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
      a. For taped connections, first apply adequate amount of rubber splicing electrical tape or electrical filler tape, followed by outer covering of vinyl insulating electrical tape.
      b. For taped connections likely to require re-entering, including motor leads, first apply varnished cambric electrical tape, followed by adequate amount of rubber splicing electrical tape, followed by outer covering of vinyl insulating electrical tape.
   2. Damp Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
      a. For connections with insulating covers, apply outer covering of moisture sealing electrical tape.
      b. For taped connections, follow same procedure as for dry locations but apply outer covering of moisture sealing electrical tape.
   3. Wet Locations: Use heat shrink tubing.

L. Insulate ends of spare conductors using vinyl insulating electrical tape.

M. Field-Applied Color Coding: Where vinyl color coding electrical tape is used in lieu of integrally colored insulation as permitted in Part 2 under "Color Coding", apply half overlapping turns of tape at each termination and at each location conductors are accessible.

N. Identify conductors and cables in accordance with Section 26 05 53.

O. Electrical contractor is responsible for providing firestopping system for all electrical penetrations through all fire-rated walls. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.

P. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

END OF SECTION

SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Grounding and bonding requirements.

B. Grounding and bonding components.

1.02 RELATED REQUIREMENTS

A. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables: Additional requirements for conductors for grounding and bonding, including conductor color coding.

B. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.

B. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; International Electrical Testing Association; 2013 (ANSI/NETA ATS).

C. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. UL 467 - Grounding and Bonding Equipment; Current Edition, Including All Revisions.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 GROUNDING AND BONDING REQUIREMENTS

A. Do not use products for applications other than as permitted by NFPA 70 and product listing.

B. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.

C. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.02 GROUNDING AND BONDING COMPONENTS

A. General Requirements:
   1. Provide products listed, classified, and labeled as suitable for the purpose intended.
   2. Provide products listed and labeled as complying with UL 467 where applicable.

B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 26 05 26:
   1. Use insulated copper conductors unless otherwise indicated.
   2. Factory Pre-fabricated Bonding Jumpers: Furnished with factory-installed ferrules; size braided cables to provide equivalent gauge of specified conductors.

C. Connectors for Grounding and Bonding:
   1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
   2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
   3. Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.

PART 3 EXECUTION

3.01 INSTALLATION

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

B. Install grounding and bonding system components in a neat and workmanlike manner in accordance with NECA 1.

END OF SECTION

SECTION 26 05 29

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Support and attachment components for equipment, conduit, cable, boxes, and other electrical work.

1.02 RELATED REQUIREMENTS

A. Section 26 05 34 - Conduit: Additional support and attachment requirements for conduits.

B. Section 26 05 37 - Boxes: Additional support and attachment requirements for boxes.

C. Section 26 51 00 - Interior Lighting: Additional support and attachment requirements for interior luminaires.

D. Section 26 56 00 - Exterior Lighting: Additional support and attachment requirements for exterior luminaires.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.

B. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. UL 5B - Strut-Type Channel Raceways and Fittings; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
   2. Coordinate the work with other trades to provide additional framing and materials required for installation.
   3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
   4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
   5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.05 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Comply with applicable building code.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements - Hangers, Supports, Anchors, and Fasteners: Corrosion-resistant materials of size and type adequate to carry the loads of equipment and conduit, including weight of wire in conduit.

B. Supports: Fabricated of structural steel or formed steel members; galvanized.

C. Anchors and Fasteners:
   1. Obtain permission from Owner before using powder-actuated anchors.
   2. Wood Elements: Use wood screws.

D. Conduit and Cable Supports: Straps, clamps, etc. suitable for the conduit or cable to be supported.
   1. Conduit Straps: One-hole or two-hole type; steel or malleable iron.

2. Conduit Clamps: Bolted type unless otherwise indicated.
3. Manufacturers:
    a. Cooper Crouse-Hinds, a division of Eaton Corporation: www.cooperindustries.com.
    b. Erico International Corporation: www.erico.com.
    c. O-Z/Gedney, a brand of Emerson Industrial Automation: www.emersonindustrial.com.
    d. Thomas & Betts Corporation: www.tnb.com.

E. Non-Penetrating Rooftop Supports for Low-Slope Roofs: Steel pedestals with thermoplastic or rubber bases that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified.
1. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
2. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports.
3. Mounting Height: Provide minimum clearance of 6 inches under supported component to top of roofing.
4. Manufacturers:
    a. Cooper B-Line, a division of Eaton Corporation: www.cooperindustries.com.
    b. Erico International Corporation: www.erico.com.
    c. PHP Systems/Design: www.phpsd.com.
    d. Unistrut, a brand of Atkore International Inc: www.unistrut.com.
    e. Substitutions: See Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that mounting surfaces are ready to receive support and attachment components.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

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

B. Install support and attachment components in a neat and workmanlike manner in accordance with NECA 1.

C. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

D. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

E. Unless specifically indicated or approved by Architect/Architect, do not provide support from suspended ceiling support system or ceiling grid.

F. Unless specifically indicated or approved by Architect/Architect, do not provide support from roof deck.

G. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

H. Equipment Support and Attachment:
1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

I. Conduit Support and Attachment: Also comply with Section 26 05 34.

J. Box Support and Attachment: Also comply with Section 26 05 37.

K. Interior Luminaire Support and Attachment: Also comply with Section 26 51 00.

L. Exterior Luminaire Support and Attachment: Also comply with Section 26 56 00.

M. Secure fasteners according to manufacturer's recommended torque settings.

N. Remove temporary supports.

O. Install hangers and supports as required to adequately and securely support electrical system components, in a neat and workmanlike manner, as specified in NECA 1.
   1. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.
   2. Obtain permission from Owner before drilling, welding, or cutting structural members.

P. Rigidly weld support members or use hexagon-head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.

Q. Install surface-mounted variable frequency drive cabinets with minimum of four anchors.

R. In wet and damp locations use steel channel supports to stand variable frequency drive cabinets 1 inch off wall.

S. Use sheet metal channel to bridge studs above and below variable frequency drive cabinets recessed in hollow partitions.

3.03 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Inspect support and attachment components for damage and defects.

C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

D. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION

SECTION 26 05 34
CONDUIT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Galvanized steel rigid metal conduit (RMC).

B. Flexible metal conduit (FMC).

C. Liquidtight flexible metal conduit (LFMC).

D. Electrical metallic tubing (EMT).

E. Conduit fittings.

F. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables: Metal clad cable (Type MC), armored cable (Type AC), and manufactured wiring systems, including uses permitted.

B. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

C. Section 26 05 29 - Hangers and Supports for Electrical Systems.

D. Section 26 05 37 - Boxes.

E. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS

A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2005.

B. ANSI C80.3 - American National Standard for Steel Electrical Metallic Tubing (EMT); 2005.

C. ANSI C80.5 - American National Standard for Electrical Rigid Aluminum Conduit (ERAC); 2005.

D. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.

E. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); National Electrical Contractors Association; 2013.

F. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; National Electrical Manufacturers Association; 2012 (ANSI/NEMA FB 1).

G. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. UL 1 - Flexible Metal Conduit; Current Edition, Including All Revisions.

I. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.

J. UL 360 - Liquid-Tight Flexible Steel Conduit; Current Edition, Including All Revisions.

K. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.

L. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.

M. UL 1660 - Liquid-Tight Flexible Nonmetallic Conduit; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate minimum sizes of conduits with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
2. Coordinate the arrangement of conduits with structural members, ductwork, piping, equipment and other potential conflicts installed under other sections or by others.

3. Verify exact conduit termination locations required for boxes, enclosures, and equipment installed under other sections or by others.
4. Coordinate the work with other trades to provide roof penetrations that preserve the integrity of the roofing system and do not void the roof warranty.
5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

B. Sequencing:
1. Do not begin installation of conductors and cables until installation of conduit is complete between outlet, junction and splicing points.

1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Products: Listed and classified by Underwriters Laboratories Inc. or testing firm acceptable to authority having jurisdiction as suitable for purpose specified and shown.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

B. Accept conduit on site. Inspect for damage.

C. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

PART 2 PRODUCTS

2.01 CONDUIT APPLICATIONS

A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70 and product listing.

B. Unless otherwise indicated and where not otherwise restricted, use the conduit types indicated for the specified applications. Where more than one listed application applies, comply with the most restrictive requirements. Where conduit type for a particular application is not specified, use galvanized steel rigid metal conduit.

C. Connections to Vibrating Equipment:
1. Dry Locations: Use flexible metal conduit.
2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit.
3. Maximum Length: 6 feet unless otherwise indicated.
4. Vibrating equipment includes, but is not limited to:
a. Transformers.
b. Motors.

2.02 CONDUIT REQUIREMENTS

A. Existing Work: Where existing conduits are indicated to be reused, they may be reused only where they comply with specified requirements, are free from corrosion, and integrity is verified by pulling a mandrel through them.

B. Provide all conduit, fittings, supports, and accessories required for a complete raceway system.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Minimum Conduit Size, Unless Otherwise Indicated:
1. Branch Circuits: 1/2 inch (16 mm) trade size.
2. Branch Circuit Homeruns: 3/4 inch (21 mm) trade size.
3. Control Circuits: 1/2 inch (16 mm) trade size.

E. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.03 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Manufacturers:

1. Allied Tube & Conduit: www.alliedeg.com.
2. Beck Manufacturing, Inc: www.beckmfg.com.
3. Triangle PWC
4. Western Tube and Conduit
5. Wheatland Tube Company: www.wheatland.com.
6. Substitutions: See Section 01 60 00 - Product Requirements.

B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.

C. Fittings:
1. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
2. Material: Use steel or malleable iron.
3. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.04 FLEXIBLE METAL CONDUIT (FMC)

A. Manufacturers:
1. AFC Cable Systems, Inc; _____: www.afcweb.com.
2. Anamet (type DE-710).
3. Electri-Flex Company; _____: www.electriflex.com.
4. International Metal Hose; _____: www.metalhose.com.
5. Triangle PWC (type 710).
6. Substitutions: See Section 01 60 00 - Product Requirements.

B. Description: NFPA 70, Type FMC standard wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems to be used.

C. Fittings:
1. Manufacturers:
a. Bridgeport Fittings Inc: www.bptfittings.com.
b. O-Z/Gedney, a brand of Emerson Industrial Automation: www.emersonindustrial.com.
c. Thomas & Betts Corporation: www.tnb.com.
d. Substitutions: See Section 01 60 00 - Product Requirements.
2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Material: Use steel or malleable iron.
a. Do not use die cast zinc fittings.

2.05 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

A. Manufacturers:
1. AFC Cable Systems, Inc; _____: www.afcweb.com.
2. Alflex
3. Anamet (type "UA")
4. Electri-Flex Company; _____: www.electriflex.com.
5. International Metal Hose; _____: www.metalhose.com.
6. Thomas & Betts Corporation: www.tnb.com.
7. Substitutions: See Section 01 60 00 - Product Requirements.

B. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.

C. Fittings:
1. Manufacturers:
a. Bridgeport Fittings Inc: www.bptfittings.com.
b. O-Z/Gedney, a brand of Emerson Industrial Automation: www.emersonindustrial.com.

c. Thomas & Betts Corporation: www.tnb.com.
d. Substitutions: See Section 01 60 00 - Product Requirements.

2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Material: Use steel or malleable iron.

2.06 ELECTRICAL METALLIC TUBING (EMT)

A. Manufacturers:
1. Allied Tube & Conduit; _____: www.alliedeg.com.
2. Beck Manufacturing, Inc: www.beckmfg.com
3. Triangle PWC.
4. Wheatland Tube Company; _____: www.wheatland.com.
5. Substitutions: See Section 01 60 00 - Product Requirements.

B. Description: NFPA 70, Type EMT steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.

C. Fittings:
1. Manufacturers:
a. Bridgeport Fittings Inc: www.bptfittings.com.
b. O-Z/Gedney, a brand of Emerson Industrial Automation: www.emersonindustrial.com.
c. Thomas & Betts Corporation: www.tnb.com.
d. Substitutions: See Section 01 60 00 - Product Requirements.
2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Material: Use steel or malleable iron.
a. Do not use die cast zinc fittings.
4. Connectors and Couplings: Use compression (gland) or set-screw type.
a. Do not use indenter type connectors and couplings.
5. Damp or Wet Locations (where permitted): Use fittings listed for use in wet locations.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on drawings.

B. Verify that mounting surfaces are ready to receive conduits.

C. Verify that conditions are satisfactory for installation prior to starting work.

D. Verify routing and termination locations of conduit prior to rough-in.

E. Conduit routing is shown on drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

3.02 INSTALLATION

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

B. Install conduit in a neat and workmanlike manner in accordance with NECA 1.

C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.

D. Conduit Routing:
1. Unless dimensioned, conduit routing indicated is diagrammatic.
2. When conduit destination is indicated and routing is not shown, determine exact routing required.
3. Conceal all conduits unless specifically indicated to be exposed.
4. Conduits in the following areas may be exposed, unless otherwise indicated:
a. Electrical rooms.
b. Mechanical equipment rooms.

5. Arrange conduit to provide no more than the equivalent of four 90 degree bends between pull points.
6. Route conduits above water and drain piping where possible.
7. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
8. Maintain minimum clearance of 6 inches between conduits and piping for other systems.
9. Maintain minimum clearance of 12 inches between conduits and hot surfaces. This includes, but is not limited to:
    a. Heaters.
    b. Hot water piping.
    c. Flues.
10. Group parallel conduits in the same area together on a common rack.

E. Conduit Support:
1. Secure and support conduits in accordance with NFPA 70 and Section 26 05 29 using suitable supports and methods approved by the authority having jurisdiction.
2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
3. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.

F. Connections and Terminations:
1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
3. Use suitable adapters where required to transition from one type of conduit to another.
4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
6. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.
7. Secure joints and connections to provide maximum mechanical strength and electrical continuity.

G. Penetrations:
1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
2. Make penetrations perpendicular to surfaces unless otherwise indicated.
3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
4. Provide suitable modular seal where conduits penetrate exterior wall below grade.
5. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
6. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty. Include proposed locations of penetrations and methods for sealing with submittals.
7. Provide metal escutcheon plates for conduit penetrations exposed to public view.

H. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
1. Where conduits cross structural joints intended for expansion, contraction, or deflection.

I. Condensation Prevention: Where conduits cross barriers between areas of potential substantial temperature differential, provide sealing fitting or approved sealing compound at an accessible point near the penetration to prevent condensation. This includes, but is not limited to:
   1. Where conduits pass from outdoors into conditioned interior spaces.
   2. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.

J. Provide grounding and bonding in accordance with Section 26 05 26.

3.03 CLEANING

A. Clean interior of conduits to remove moisture and foreign matter.

3.04 PROTECTION

A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

END OF SECTION

SECTION 26 05 37
BOXES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Outlet and device boxes up to 100 cubic inches, including those used as junction and pull boxes.

B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches.

C. Floor boxes.

1.02 RELATED REQUIREMENTS

A. Section 07 84 00 - Firestopping.

B. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

C. Section 26 05 29 - Hangers and Supports for Electrical Systems.

D. Section 26 05 34 - Conduit:
   1. Conduit bodies and other fittings.
   2. Additional requirements for locating boxes to limit conduit length and/or number of bends between pulling points.

E. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.

B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; National Electrical Contractors Association; 2010.

C. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; National Electrical Manufacturers Association; 2012 (ANSI/NEMA FB 1).

D. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; National Electrical Manufacturers Association; 2013 (ANSI/NEMA OS 1).

E. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports; National Electrical Manufacturers Association; 2013 (ANSI/NEMA OS 2).

F. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); National Electrical Manufacturers Association; 2014.

G. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

I. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

J. UL 508A - Industrial Control Panels; Current Edition, Including All Revisions.

K. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.

L. UL 514C - Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.
4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.
5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
6. Coordinate the work with other trades to preserve insulation integrity.
7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
8. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for cabinets and enclosures, boxes for hazardous (classified) locations, floor boxes, and underground boxes/enclosures.

C. Samples:
   1. Floor Boxes: Provide one sample(s) of each floor box proposed for substitution upon request.

D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

E. Project Record Documents: Record actual locations for outlet and device boxes, pull boxes, cabinets and enclosures, floor boxes, and underground boxes/enclosures.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Keys for Lockable Enclosures: Two of each different key.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 BOXES

A. General Requirements:
   1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
   2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
   3. Provide products listed, classified, and labeled as suitable for the purpose intended.
   4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
   5. Provide grounding terminals within boxes where equipment grounding conductors terminate.

B. Outlet and Device Boxes Up to 100 cubic inches, Including Those Used as Junction and Pull Boxes:
   1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
   2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
   3. Use suitable concrete type boxes where flush-mounted in concrete.
   4. Use suitable masonry type boxes where flush-mounted in masonry walls.
   5. Use raised covers suitable for the type of wall construction and device configuration where required.
   6. Use shallow boxes where required by the type of wall construction.
   7. Do not use "through-wall" boxes designed for access from both sides of wall.
   8. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
   9. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
   10. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
   11. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes.
   12. Minimum Box Size, Unless Otherwise Indicated:
      a. Wiring Devices (Other Than Communications Systems Outlets): 4 inch square by 1-1/2 inch deep (100 by 38 mm) trade size.
      b. Ceiling Outlets: 4 inch octagonal or square by 1-1/2 inch deep (100 by 38 mm) trade size.
   13. Manufacturers:
      a. Cooper Crouse-Hinds, a division of Eaton Corporation: www.cooperindustries.com.
      b. Hubbell Incorporated; Bell Products; _____: www.hubbell-rtb.com.
      c. Hubbell Incorporated; RACO Products; _____: www.hubbell-rtb.com.
      d. O-Z/Gedney, a brand of Emerson Industrial Automation: www.emersonindustrial.com.
      e. Thomas & Betts Corporation: www.tnb.com.
      f. Substitutions: See Section 01 60 00 - Product Requirements.

C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches:
   1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
   2. NEMA 250 Environment Type, Unless Otherwise Indicated:
      a. Indoor Clean, Dry Locations: Type 1, painted steel.
      b. Outdoor Locations: Type 4X, fiberglass, non-metallic.
   3. Junction and Pull Boxes Larger Than 100 cubic inches:
      a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.
      b. Boxes 6 square feet and Larger: Provide sectionalized screw-cover or hinged-cover enclosures.
   4. Cabinets and Hinged-Cover Enclosures, Other Than Junction and Pull Boxes:
      a. Provide lockable hinged covers, all locks keyed alike unless otherwise indicated.
      b. Back Panels: Painted steel, removable.
      c. Terminal Blocks: Provide voltage/current ratings and terminal quantity suitable for purpose indicated, with 25 percent spare terminal capacity.
   5. Finish for Painted Steel Enclosures: Manufacturer's standard grey unless otherwise indicated.
   6. Manufacturers:
      a. Cooper B-Line, a division of Eaton Corporation: www.cooperindustries.com.
      b. Hoffman, a brand of Pentair Technical Products: www.hoffmanonline.com.
      c. Hubbell Incorporated; Wiegmann Products: www.hubbell-wiegmann.com.

d. Stahlin Non-Metallic Enclosures: Robroy Industries: www.robroy.com.
e. Substitutions: See Section 01 60 00 - Product Requirements.

D. Floor Boxes:
1. Description: Floor boxes compatible with floor box service fittings provided in accordance with Section 26 27 26; with partitions to separate multiple services; furnished with all components, adapters, and trims required for complete installation.
2. Use cast iron floor boxes within slab on grade.
3. Use sheet-steel or cast iron floor boxes within slab above grade.
4. Metallic Floor Boxes: Fully adjustable (with integral means for leveling adjustment prior to and after concrete pour).
5. Manufacturer: Same as manufacturer of floor box service fittings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on drawings.

B. Verify that mounting surfaces are ready to receive boxes.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

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

B. Perform work in a neat and workmanlike manner in accordance with NECA 1 and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.

E. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.

F. Unless otherwise indicated, boxes may be surface-mounted where exposed conduits are indicated or permitted.

G. Box Locations:
1. Locate boxes to be accessible. Provide access panels in accordance with Section 08 31 00 as required where approved by the Architect.
2. Unless dimensioned, box locations indicated are approximate.
3. Locate boxes as required for devices installed under other sections or by others.
4. Locate boxes so that wall plates do not span different building finishes.
5. Locate boxes so that wall plates do not cross masonry joints.
6. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.
7. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches horizontal separation unless otherwise indicated.
8. Acoustic-Rated Walls: Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches horizontal separation.
9. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.
a. Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches separation where wall is constructed with individual noncommunicating stud cavities or protect both boxes with listed putty pads.
b. Do not install flush-mounted boxes with area larger than 16 square inches or such that the total aggregate area of openings exceeds 100 square inches for any 100 square feet of wall area.

10. Locate junction and pull boxes as indicated, as required to facilitate installation of conductors, and to limit conduit length and/or number of bends between pulling points in accordance with Section 26 05 34.
11. Locate junction and pull boxes in the following areas, unless otherwise indicated or approved by the Architect:
    a. Concealed above accessible suspended ceilings.
    b. Within joists in areas with no ceiling.
    c. Electrical rooms.
    d. Mechanical equipment rooms.
    e. Rooftop.

H. Box Supports:
1. Secure and support boxes in accordance with NFPA 70 and Section 26 05 29 using suitable supports and methods approved by the authority having jurisdiction.
2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.
3. Installation Above Suspended Ceilings: Do not provide support from ceiling grid or ceiling support system.
4. Use far-side support to secure flush-mounted boxes supported from single stud in hollow stud walls. Repair or replace supports for boxes that permit excessive movement.

I. Install boxes plumb and level.

J. Flush-Mounted Boxes:
1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch or does not project beyond finished surface.
2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch at the edge of the box.

K. Install boxes as required to preserve insulation integrity.

L. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

M. Electrical contractor is responsible for providing firestopping system for all electrical penetrations through all fire-rated walls. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.

N. Close unused box openings.

O. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.

P. Provide grounding and bonding in accordance with Section 26 05 26.

Q. Identify boxes in accordance with Section 26 05 53.

3.03 CLEANING

A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

3.04 PROTECTION

A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

END OF SECTION

SECTION 26 05 53
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical identification requirements.

B. Identification nameplates and labels.

C. Wire and cable markers.

D. Voltage markers.

E. Warning signs and labels.

1.02 RELATED REQUIREMENTS

A. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.

1.03 REFERENCE STANDARDS

A. ANSI Z535.2 - American National Standard for Environmental and Facility Safety Signs; 2011.

B. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels; 2011.

C. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. NFPA 70E - Standard for Electrical Safety in the Workplace; National Fire Protection Association; 2015.

E. UL 969 - Marking and Labeling Systems; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Verify final designations for equipment, systems, and components to be identified prior to fabrication of identification products.

B. Sequencing:
   1. Do not conceal items to be identified, in locations such as above suspended ceilings, until identification products have been installed.
   2. Do not install identification products until final surface finishes and painting are complete.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittals procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.

C. Shop Drawings: Provide schedule of items to be identified indicating proposed designations, materials, legends, and formats.

D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation and installation of product.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

PART 2 PRODUCTS

2.01 IDENTIFICATION REQUIREMENTS

A. Existing Work: Unless specifically excluded, identify existing elements to remain that are not already identified in accordance with specified requirements.

B. Identification for Equipment:

1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
    a. Panelboards:
        1) Identify ampere rating.
        2) Identify voltage and phase.
        3) Identify power source and circuit number. Include location when not within sight of equipment.
        4) Identify main overcurrent protective device. Use identification label for panelboards with a door. For power distribution panelboards without a door, use identification nameplate.
        5) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.
    b. Enclosed switches, circuit breakers, and variable frequency motor controllers:
        1) Identify voltage and phase.
        2) Identify power source and circuit number. Include location when not within sight of equipment.
        3) Identify load(s) served. Include location when not within sight of equipment.
    c. Enclosed Contactors:
        1) Identify ampere rating.
        2) Identify voltage and phase.
        3) Identify configuration, e.g., E.O.E.H. (electrically operated, electrically held) or E.O.M.H. (electrically operated, mechanically held).
        4) Identify coil voltage.
        5) Identify load(s) and associated circuits controlled. Include location.
2. Use voltage marker to identify highest voltage present for each piece of electrical equipment.
3. Use identification nameplate to identify equipment utilizing series ratings, where permitted, in accordance with NFPA 70.
4. Use identification nameplate to identify switchboards and panelboards utilizing a high leg delta system in accordance with NFPA 70.
5. Use identification nameplate to identify disconnect location for equipment with remote disconnecting means.
6. Use identification label or handwritten text using indelible marker on inside of door at each fused switch to identify required NEMA fuse class and size.
7. Use identification label or handwritten text using indelible marker on inside of door at each motor controller to identify nameplate horsepower, full load amperes, code letter, service factor, voltage, and phase of motor(s) controlled.
8. Use warning signs to identify electrical hazards for entrances to all rooms and other guarded locations that contain exposed live parts operating at 600 V nominal or less with the word message "DANGER; Electrical hazard; Authorized personnel only" or approved equivalent.
9. Use warning labels to identify electrical hazards for equipment, compartments, and enclosures containing exposed live parts or exposed conductors operating at over 600 V nominal with the word message "DANGER; HIGH VOLTAGE; KEEP OUT".
10. Use warning labels, identification nameplates, or identification labels to identify electrical hazards for equipment where multiple power sources are present with the word message "DANGER; Hazardous voltage; Multiple power sources may be present; Disconnect all electric power including remote disconnects before servicing" or approved equivalent.

C. Identification for Conductors and Cables:
    1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 05 19.
    2. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.

3. Use wire and cable markers to identify circuit number or other designation indicated for power, control, and instrumentation conductors and cables at the following locations:
    a. At each source and load connection.
    b. Within boxes when more than one circuit is present.
    c. Within equipment enclosures when conductors and cables enter or leave the enclosure.

D. Identification for Raceways:
1. Use voltage markers to identify highest voltage present for accessible conduits at maximum intervals of 20 feet.
2. Use voltage markers or color-coded bands to identify systems other than normal power system for accessible conduits at maximum intervals of 20 feet.
    a. Color-Coded Bands: Use vinyl color coding electrical tape to mark bands 3 inches wide.
        1) Vinyl Color Coding Electrical Tape: Comply with Section 26 05 19.
3. Use identification labels, handwritten text using indelible marker, or plastic marker tags to identify circuits enclosed for accessible conduits at wall penetrations, at floor penetrations, at roof penetrations, and at equipment terminations when source is not within sight.
4. Use identification labels, handwritten text using indelible marker, or plastic marker tags to identify spare conduits at each end. Identify purpose and termination location.
5. Use voltage markers to identify highest voltage present for wireways at maximum intervals of 20 feet.

E. Identification for Boxes:
1. Use voltage markers to identify highest voltage present.
2. Use voltage markers or color coded boxes to identify systems other than normal power system.
3. Use identification labels or handwritten text using indelible marker to identify circuits enclosed.
    a. For exposed boxes in public areas, use only identification labels.
4. Use warning labels to identify electrical hazards for boxes containing exposed live parts or exposed conductors operating at over 600 V nominal with the word message "DANGER; HIGH VOLTAGE; KEEP OUT".

F. Identification for Devices:
1. Use identification label or engraved wallplate to identify serving branch circuit for all receptacles.
    a. For receptacles in public areas or in areas as directed by Architect, provide identification on inside surface of wallplate.
2. Use identification label or engraved wallplate to identify load controlled for wall-mounted control devices controlling loads that are not visible from the control location and for multiple wall-mounted control devices installed at one location.
3. Use identification label to identify receptacles protected by upstream GFI protection, where permitted.

G. Identification for Luminaires:
1. Use permanent red dot on luminaire frame to identify luminaires connected to emergency power system.

2.02 IDENTIFICATION NAMEPLATES AND LABELS

A. Identification Nameplates:
1. Manufacturers:
    a. Brimar Industries, Inc: www.brimar.com.
    b. Kolbi Pipe Marker Co; _____: www.kolbipipemarkers.com.
    c. Seton Identification Products; _____: www.seton.com.
    d. Substitutions: See Section 01 60 00 - Product Requirements.
2. Materials:
    a. Indoor Clean, Dry Locations: Use plastic nameplates.

b. Outdoor Locations: Use plastic, stainless steel, or aluminum nameplates suitable for exterior use.

3. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch; engraved text.
   a. Exception: Provide minimum thickness of 1/8 inch when any dimension is greater than 4 inches.
4. Stainless Steel Nameplates: Minimum thickness of 1/32 inch; engraved or laser-etched text.
5. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch; engraved or laser-etched text.
6. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch high; Four, located at corners for larger sizes.

B. Identification Labels:
1. Manufacturers:
   a. Brady Corporation; _____: www.bradyid.com.
   b. Brother International Corporation: www.brother-usa.com.
   c. Panduit Corp: www.panduit.com.
2. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
3. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.

C. Format for Equipment Identification:
1. Minimum Size: 1 inch by 2.5 inches.
2. Legend:
   a. System designation where applicable:
      1) Low Voltage System: Identify CAUTION: High Voltage.
   b. Equipment designation or other approved description.
   c. Other information as indicated.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height:
   a. System Designation: 1 inch.
   b. Equipment Designation: 1/2 inch.
   c. Other Information: 1/4 inch.
   d. Exception: Provide minimum text height of 1 inch for equipment located more than 10 feet above floor or working platform.
5. Color:
   a. Normal Power System: White text on black background.

D. Format for General Information and Operating Instructions:
1. Minimum Size: 1 inch by 2.5 inches.
2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 1/4 inch.
5. Color: Black text on white background unless otherwise indicated.

E. Format for Caution and Warning Messages:
1. Minimum Size: 2 inches by 4 inches.
2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 1/2 inch.
5. Color: Black text on yellow background unless otherwise indicated.

F. Format for Receptacle Identification:

1. Minimum Size: 3/8 inch by 1.5 inches.
2. Legend: Power source and circuit number or other designation indicated.
   a. Include voltage and phase for other than 120 V, single phase circuits.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch.
5. Color: Black text on clear background.

G. Format for Control Device Identification:
1. Minimum Size: 3/8 inch by 1.5 inches.
2. Legend: Load controlled or other designation indicated.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch.
5. Color: Black text on clear background.

2.03 WIRE AND CABLE MARKERS

A. Manufacturers:
1. Brady Corporation; _____: www.bradyid.com.
2. HellermannTyton; _____: www.hellermanntyton.com.
3. Panduit Corp: www.panduit.com.
4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve, plastic clip-on, or vinyl split sleeve type markers suitable for the conductor or cable to be identified.

C. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.

D. Legend: Power source and circuit number or other designation indicated.

E. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.
1. Do not use handwritten text.

F. Minimum Text Height: 1/8 inch.

G. Color: Black text on white background unless otherwise indicated.

2.04 VOLTAGE MARKERS

A. Manufacturers:
1. Brady Corporation; _____: www.bradyid.com.
2. Brimar Industries, Inc: www.brimar.com.
3. Seton Identification Products; _____: www.seton.com.
4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Markers for Conduits: Use factory pre-printed self-adhesive vinyl, self-adhesive vinyl cloth, or vinyl snap-around type markers.

C. Markers for Boxes and Equipment Enclosures: Use factory pre-printed self-adhesive vinyl or self-adhesive vinyl cloth type markers.

D. Minimum Size:
1. Markers for Equipment: 1 1/8 by 4 1/2 inches.
2. Markers for Conduits: As recommended by manufacturer for conduit size to be identified.
3. Markers for Pull Boxes: 1 1/8 by 4 1/2 inches.
4. Markers for Junction Boxes: 1/2 by 2 1/4 inches.

E. Legend:
1. Markers for Voltage Identification: Highest voltage present.
2. Markers for System Identification:
   a. Other Systems: Type of service.

F. Color: Black text on orange background unless otherwise indicated.

2.05 WARNING SIGNS AND LABELS

A. Manufacturers:
   1. Brimar Industries, Inc: www.brimar.com.
   2. Clarion Safety Systems, LLC; _____: www.clarionsafety.com.
   3. Seton Identification Products; _____: www.seton.com.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.

C. Warning Signs:
   1. Materials:
      a. Indoor Dry, Clean Locations: Use factory pre-printed rigid plastic or self-adhesive vinyl signs.
      b. Outdoor Locations: Use factory pre-printed rigid aluminum signs.
   2. Rigid Signs: Provide four mounting holes at corners for mechanical fasteners.
   3. Minimum Size: 7 by 10 inches unless otherwise indicated.

D. Warning Labels:
   1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
   2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.
   3. Minimum Size: 2 by 4 inches unless otherwise indicated.

PART 3 EXECUTION

3.01 PREPARATION

A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

3.02 INSTALLATION

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

B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
   1. Surface-Mounted Equipment: Enclosure front.
   2. Flush-Mounted Equipment: Inside of equipment door.
   3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
   4. Elevated Equipment: Legible from the floor or working platform.
   5. Branch Devices: Adjacent to device.
   6. Interior Components: Legible from the point of access.
   7. Conduits: Legible from the floor.
   8. Boxes: Outside face of cover.
   9. Conductors and Cables: Legible from the point of access.
   10. Devices: Outside face of cover.

C. Install identification products centered, level, and parallel with lines of item being identified.

D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.
   1. Do not use adhesives on exterior surfaces except where substrate can not be penetrated.

E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.

F. Secure rigid signs using stainless steel screws.

G. Mark all handwritten text, where permitted, to be neat and legible.

3.03 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.

END OF SECTION

SECTION 26 05 73
POWER SYSTEM STUDIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Criteria for the selection and adjustment of equipment and associated protective devices not specified in this section, as determined by studies to be performed.

1.02 RELATED REQUIREMENTS

A. Section 26 24 16 - Panelboards.

1.03 REFERENCE STANDARDS

A. NEMA MG 1 - Motors and Generators; 2014.

B. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; International Electrical Testing Association; 2013 (ANSI/NETA ATS).

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work to provide equipment and associated protective devices complying with criteria for selection and adjustment, as determined by studies to be performed.
   2. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Submit study reports prior to or concurrent with product submittals.
   2. Do not order equipment until matching study reports and product submittals have both been evaluated by Architect.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Study reports, stamped or sealed and signed by study preparer.

1.06 POWER SYSTEM STUDIES

A. Scope of Studies:
   1. Except where study descriptions below indicate exclusions, analyze system at each bus from primary protective devices of utility source down to each piece of equipment involved, including parts of system affecting calculations being performed (e.g. fault current contribution from motors).
   2. Include in analysis alternate sources and operating modes (including known future configurations) to determine worst case conditions.

B. General Study Requirements:
   1. Comply with NFPA 70.
   2. Perform studies utilizing computer software complying with specified requirements; manual calculations are not permitted.

C. Data Collection:
   1. Compile information on project-specific characteristics of actual installed equipment, protective devices, feeders, etc. as necessary to develop single-line diagram of electrical distribution system and associated input data for use in system modeling.
      a. Utility Source Data: Include primary voltage, maximum and minimum three-phase and line-to-ground fault currents, impedance, X/R ratio, and primary protective device information.
         1) Obtain up-to-date information from Utility Company.
      b. Generators: Include manufacturer/model, kW and voltage ratings, and impedance.

c. Motors: Include manufacturer/model, type (e.g. induction, synchronous), horsepower rating, voltage rating, full load amps, and locked rotor current or NEMA MG 1 code letter designation.
d. Transformers: Include primary and secondary voltage ratings, kVA rating, winding configuration, percent impedance, and X/R ratio.
e. Protective Devices:
1) Circuit Breakers: Include manufacturer/model, type (e.g. thermal magnetic, electronic trip), frame size, trip rating, voltage rating, interrupting rating, available field-adjustable trip response settings, and features (e.g. zone selective interlocking).
2) Fuses: Include manufacturer/model, type/class (e.g. Class J), size/rating, and speed (e.g. time delay, fast acting).
f. Protective Relays: Include manufacturer/model, type, settings, current/potential transformer ratio, and associated protective device.
g. Conductors: Include feeder size, material (e.g. copper, aluminum), insulation type, voltage rating, number per phase, raceway type, and actual length.

D. Study Reports:
1. General Requirements:
a. Identify date of study and study preparer.
b. Identify study methodology and software product(s) used.
c. Identify scope of studies, assumptions made, implications of possible alternate scenarios, and any exclusions from studies.
d. Identify base used for per unit values.
e. Include single-line diagram and associated input data used for studies; identify buses on single-line diagram as referenced in reports, and indicate bus voltage.
f. Include conclusions and recommendations.

1.07 QUALITY ASSURANCE

A. Study Preparer Qualifications: Professional electrical engineer licensed in the State in which the Project is located and with minimum five years experience in the preparation of studies of similar type and complexity using specified computer software.

B. Computer Software for Study Preparation: Use the latest edition of commercially available software utilizing specified methodologies.
1. Acceptable Software Products:
a. Power Analytics Corporation: www.poweranalytics.com.
b. SKM Systems Analysis, Inc: www.skm.com.

PART 2 PRODUCTS

PART 3 EXECUTION

3.01 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Adjust equipment and protective devices for compliance with studies and recommended settings.

D. Notify Architect of any conflicts with or deviations from studies. Obtain direction before proceeding.

END OF SECTION

SECTION 26 09 23
LIGHTING CONTROL DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Occupancy sensors.

B. Time switches.

C. In-wall time switches.

D. In-wall interval timers.

E. Outdoor photo controls.

F. Daylighting controls.

1.02 RELATED REQUIREMENTS

A. Products and Execution defined in this Section shall be commissioned. Refer to Sections 26 02 00 and 01 91 13 for scope of work and responsibilities related to commissioning.

B. Section 26 05 37 - Boxes.

C. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

D. Section 26 27 26 - Wiring Devices: Devices for manual control of lighting, including wall switches, wall dimmers, fan speed controllers, and wall plates.

E. Section 26 51 00 - Interior Lighting.

F. Section 26 56 00 - Exterior Lighting.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

B. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. UL 773A - Nonindustrial Photoelectric Switches for Lighting Control; Current Edition, Including All Revisions.

D. UL 916 - Energy Management Equipment; Current Edition, Including All Revisions.

E. UL 917 - Clock-Operated Switches; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the placement of lighting control devices with millwork, furniture, equipment, etc. installed under other sections or by others.
2. Coordinate the placement of wall switch occupancy sensors with actual installed door swings.
3. Coordinate the placement of occupancy sensors with millwork, furniture, equipment or other potential obstructions to motion detection coverage installed under other sections or by others.
4. Coordinate the placement of photo sensors for daylighting controls with windows, skylights, and luminaires to achieve optimum operation. Coordinate placement with ductwork, piping, equipment, or other potential obstructions to light level measurement installed under other sections or by others.
5. Notify Engineer and Owner's Authorized Representative of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

B. Sequencing:

1. Do not install lighting control devices until final surface finishes and painting are complete.

1.05 SUBMITTALS

A. See Section 01 3300 for submittal procedures.

B. Product Data: Include ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.
   1. Occupancy Sensors: Include detailed motion detection coverage range diagrams.

C. Shop Drawings:
   1. Occupancy Sensors: Provide lighting plan indicating location, model number, and orientation of each occupancy sensor and associated system component.
   2. Daylighting Controls: Provide lighting plan indicating location, model number, and orientation of each photo sensor and associated system component.
   3. Provide wiring schematics for occupancy sensors and daylight controls showing all components required for a complete operating system.

D. Field Quality Control Reports.

E. Manufacturer's Installation Instructions: Include application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

F. Operation and Maintenance Data: Include detailed information on device programming and setup.

G. Project Record Documents: Record actual installed locations and settings for lighting control devices.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented commercial experience.

1.07 DELIVERY, STORAGE, AND PROTECTION

A. Store products in a clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation.

1.08 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.09 WARRANTY

A. See Section 01 77 00 - Closeout Procedures, for additional warranty requirements.

B. Provide manufacturer warranty for all occupancy sensors for five years from Date of Substantial Completion.

C. Provide manufacturer warranty for all daylighting controls for two years from Date of Substantial Completion.

PART 2 PRODUCTS

2.01 ALL LIGHTING CONTROL DEVICES

A. Provide products listed and classified by Underwriters Laboratories Inc. or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

B. Unless specifically indicated to be excluded, provide all required conduit, wiring, connectors, hardware, components, accessories, etc. as required for a complete operating system.

C. Products for Switching of Electronic Fluorescent Ballasts: Tested and rated to be suitable for peak inrush currents specified in NEMA 410.

2.02 OCCUPANCY SENSORS

A. Manufacturers:

1. WattStopper; (basis of design): www.wattstopper.com.
2. Substitutions: See Section 01 25 00 - Substitution Procedures.
3. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.

B. All Occupancy Sensors:
   1. Description: Factory-assembled commercial specification grade devices for indoor use capable of sensing both major motion, such as walking, and minor motion, such as small desktop level movements, according to published coverage areas, for automatic control of load indicated.
   2. Sensor Technology:
      a. Passive Infrared (PIR) Occupancy Sensors: Designed to detect occupancy by sensing movement of thermal energy between zones.
      b. Ultrasonic Occupancy Sensors: Designed to detect occupancy by sensing frequency shifts in emitted and reflected inaudible sound waves.
      c. Passive Infrared/Ultrasonic Dual Technology Occupancy Sensors: Designed to detect occupancy using a combination of both passive infrared and ultrasonic technologies.
   3. Provide LED to visually indicate motion detection with separate color LEDs for each sensor type in dual technology units.
   4. Operation: Unless otherwise indicated, occupancy sensor to turn load on when occupant presence is detected and to turn load off when no occupant presence is detected during an adjustable turn-off delay time interval.
   5. Dual Technology Occupancy Sensors: Field configurable turn-on and hold-on activation with settings for activation by either or both sensing technologies.
   6. Passive Infrared Lens Field of View: Field customizable by addition of factory masking material, adjustment of integral blinders, or similar means to block motion detection in selected areas.
   7. Turn-Off Delay: Field adjustable, up to a maximum time delay setting of not less than 15 minutes and not more than 30 minutes. Set for 15 minute off-delay.
   8. Sensitivity: Field adjustable.
   9. Adaptive Technology: Field selectable; capable of self-adjusting sensitivity and time delay according to conditions.
   10. Compatibility: Suitable for controlling incandescent lighting, low-voltage lighting with electronic and magnetic transformers, fluorescent lighting with electronic and magnetic ballasts, and fractional motor loads, with no minimum load requirements.
   11. Load Rating for Line Voltage Occupancy Sensors:
      a. Incandescent Load: Not less than 800 W.
      b. Fluorescent Load: Not less than 800 W at 120 V ac and 1,200 W at 277 V ac.
   12. Isolated Relay for Low Voltage Occupancy Sensors: SPDT dry contacts, ratings as required for interface with system indicated.

C. Ceiling Mounted Occupancy Sensors:
   1. All Ceiling Mounted Occupancy Sensors:
      a. Description: Low profile occupancy sensors designed for ceiling installation.
      b. Unless otherwise indicated or required to control the load indicated on the drawings, provide low voltage units, for use with separate compatible accessory power packs.
      c. Occupancy sensor to be field selectable as either manual-on/automatic-off or automatic on/off.
      d. Finish: White unless otherwise indicated.
   2. Passive Infrared (PIR) Ceiling Mounted Occupancy Sensors:
      a. Standard Range Sensors: Capable of detecting motion within an area of 450 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.
      b. Extended Range Sensors: Capable of detecting motion within an area of 1,200 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.
   3. Ultrasonic Ceiling Mounted Occupancy Sensors:

a. Standard Range Sensors: Capable of detecting motion within an area of 500 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.
b. Medium Range Sensors: Capable of detecting motion within an area of 1,000 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.
c. Extended Range Sensors: Capable of detecting motion within an area of 2,000 square feet at a mounting height of 9 feet.

4. Passive Infrared/Ultrasonic Dual Technology Ceiling Mounted Occupancy Sensors:
a. Standard Range Sensors: Capable of detecting motion within an area of 450 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.
b. Extended Range Sensors: Capable of detecting motion within an area of 1,200 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.

2.03 RELAY PANEL

A. Digital Electronic Time Switches:
1. Description: Factory-assembled solid state programmable controller with LCD display, listed and labeled as complying with UL 916 or UL 917.
2. Program Capability:
a. 24-Hour Time Switches: Single channel, with same schedule for each day of the week and skip-a-day feature to omit selected days.
b. 7-Day Time Switches: Single channel, capable of different schedule for each day of the week with additional holiday schedule available to override normal schedule for selected days.
c. Astronomic Time Switches: Single channel, capable of different schedule for each day of the week with additional holiday schedule available to override normal schedule for selected days and field-configurable astronomic feature to automatically adjust for seasonal changes in sunrise and sunset times.
3. Schedule Capacity: Not less than 16 programmable on/off operations.
4. Provide automatic daylight savings time and leap year compensation.
5. Provide power outage backup to retain programming and maintain clock.
6. Manual override: Capable of overriding current schedule both permanently and temporarily until next scheduled event.
7. Input Supply Voltage: as required for load being controlled.
8. Output Switch Configuration: As required to control the load indicated on the drawings.
9. Output Switch Contact Ratings: As required to control the load indicated on the drawings.

B. 8 Pole, 20 amp, 480 volt rated relay contacts.

2.04 IN-WALL INTERVAL TIMERS

A. Digital Electronic In-Wall Interval Timers:
1. Description: Factory-assembled solid state programmable controller, suitable for mounting in standard wall box, and listed and labeled as complying with UL 916 or UL 917.
2. Program Capability: Designed to turn load off at end of preset time interval.
3. Time Interval: Preset intervals of OFF, 5 min, 10 min, 15 min and 30 min.
4. Switch Configuration: SPST.
5. Contact Ratings:
a. Resistive Load: Not less than 20 A at 120-277 V ac.
b. Tungsten Load: Not less than 15 A at 120 V ac.
c. Ballast Load: Not less than 16 A at 120-277 V ac.
d. Motor Load: Not less than 1 HP at 120 V ac or 2 HP at 240 V ac.

2.05 OUTDOOR PHOTO CONTROLS

A. Wall-Mounted Outdoor Photo Controls:
1. Description: Direct-wired photo control unit with field-adjustable swivel base, listed and labeled as complying with UL 773A.
2. Housing: Weatherproof, impact resistant polycarbonate.
3. Photo Sensor: Cadmium sulfide.

4. Provide external sliding shield for field adjustment of light level activation.
5. Light Level Activation: 1 to 5 footcandles turn-on and 3 to 1 turn-off to turn-on ratio with delayed turn-off.
6. Voltage: As required to control the load indicated on the drawings.
7. Failure Mode: Fails to the on position.
8. Load Rating: As required to control the load indicated on the drawings.

2.06 DAYLIGHTING CONTROLS

A. System Description: Control system consisting of photo sensors and compatible control modules and power packs for automatic control of load indicated according to available natural light; capable of integrating with occupancy sensors and manual override controls. Three programmable zones of control with separate relay for each zone to allow on / off operation of lighting zone.

B. Daylighting Control Photo Sensors: Low voltage class 2 photo sensor units with output signal proportional to the measured light level and provision for zero or offset based signal.
   1. Sensor Type: Filtered silicon photo diode.
   2. Sensor Range:
      a. Indoor Photo Sensors: 5 to 100 footcandles.

C. Dimming Photo Sensors: Photo sensor units with integral controller compatible with specified dimming ballasts, for direct continuous dimming of up to 50 ballasts.

D. Daylighting Control Switching Modules: Low voltage class 2 control unit compatible with specified photo sensors, for switching of compatible power packs, contactors, or relays in response to changes in measured light levels according to selected settings.
   1. Operation: Unless otherwise indicated, load to be turned on when light level is below selected low set point and load to be turned off when light level is above selected high set point, with a no switching dead band between set points to prevent unwanted cycling.
   2. Input Delay: To prevent unwanted cycling due to intermittent light level fluctuations.
   3. Control Capability:
      a. Three Zone Switching Module: Capable of controlling one programmable channel.

E. Power Packs for Daylighting Control Modules:
   1. Description: Plenum rated, self-contained low voltage class 2 transformer and relay compatible with specified low voltage daylighting control modules for switching of line voltage loads. Provide quantity and configuration of power and slave packs with all associated wiring and accessories as required to control the load indicated on the drawings.
   2. Input Supply Voltage: As indicated on the drawings.
   3. Load Ratings:
      a. Power Packs for Single Zone Control Modules:
         1) Incandescent Load: Not less than 15 A.
         2) Fluorescent Load: Not less than 20 A.
         3) Motor Load: Not less than 1 HP.
      b. Power Packs for Multi-Zone Control Modules: 620 VA.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

B. Verify that openings for outlet boxes are neatly cut and will be completely covered by devices or wall plates.

C. Verify that final surface finishes are complete, including painting.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to lighting control devices.

E. Verify that the service voltage and ratings of lighting control devices are appropriate for the service voltage and load requirements at the location to be installed.

F. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Perform work in a neat and workmanlike manner in accordance with NECA 1 and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Coordinate locations of outlet boxes provided under Section 26 05 37 as required for installation of lighting control devices provided under this section.
   1. Orient outlet boxes for vertical installation of lighting control devices unless otherwise indicated.

C. Install lighting control devices in accordance with manufacturer's instructions.

D. Unless otherwise indicated, connect lighting control device grounding terminal or conductor to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

E. Install lighting control devices plumb and level, and held securely in place.

F. Where required and not furnished with lighting control device, provide wall plate in accordance with Section 26 27 26.

G. Where applicable, install lighting control devices and associated wall plates to fit completely flush to mounting surface with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

H. Identify lighting control devices in accordance with Section 26 05 53.

I. Occupancy Sensor Locations:
   1. Location Adjustments: Locations indicated are diagrammatic and only intended to indicate which rooms or areas require devices. Provide quantity and locations as required for complete coverage of respective room or area based on manufacturer's recommendations for installed devices.
   2. Locate ultrasonic and dual technology passive infrared/ultrasonic occupancy sensors a minimum of 4 feet from air supply ducts or other sources of heavy air flow and as per manufacturer's recommendations, in order to minimize false triggers.

J. Outdoor Photo Control Locations:
   1. Where possible, locate outdoor photo controls with photo sensor facing north. If north facing photo sensor is not possible, install with photo sensor facing east, west, or down.
   2. Locate outdoor photo controls so that photo sensors do not face artificial light sources, including light sources controlled by the photo control itself.

K. Install outdoor photo controls so that connections are weatherproof. Do not install photo controls with conduit stem facing up in order to prevent infiltration of water into the photo control.

L. Daylighting Control Photo Sensor Locations:
   1. Location Adjustments: Locations indicated are diagrammatic and only intended to indicate which rooms or areas require devices. Provide quantity and locations as required for proper control of respective room or area based on manufacturer's recommendations for installed devices.
   2. Unless otherwise indicated, locate photo sensors for closed loop systems to accurately measure the light level controlled at the designated task location, while minimizing the measured amount of direct light from natural or artificial sources such as windows or pendant luminaires.

3. Unless otherwise indicated, locate photo sensors for open loop systems to accurately measure the level of daylight coming into the space, while minimizing the measured amount of lighting from artificial sources.

M. Unless otherwise indicated, install power packs for lighting control devices above accessible ceiling or above access panel in inaccessible ceiling near the sensor location.

N. Where indicated, install separate compatible wall switches for manual control interface with lighting control devices or associated power packs.

O. Unless otherwise indicated, install switches on load side of power packs so that switch does not turn off power pack.

3.04 FIELD QUALITY CONTROL

A. See Section 01 45 00 - Quality Control, for additional requirements.

B. Inspect each lighting control device for damage and defects.

C. Test occupancy sensors to verify proper operation, including time delays and ambient light thresholds where applicable. Verify optimal coverage for entire room or area. Record test results in written report to be included with submittals.

D. Test time switches to verify proper operation.

E. Test outdoor photo controls to verify proper operation, including time delays where applicable.

F. Test daylighting controls to verify proper operation, including light level measurements and time delays where applicable. Record test results in written report to be included with submittals.

G. Correct wiring deficiencies and replace damaged or defective lighting control devices.

3.05 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

B. Adjust occupancy sensor settings to minimize undesired activations while optimizing energy savings, and to achieve desired function as indicated or as directed by Architect and Owner's Authorized Representative.

C. Where indicated or as directed by Architect and Owner's Authorized Representative, install factory masking material or adjust integral blinders on passive infrared (PIR) and dual technology occupancy sensor lenses to block undesired motion detection.

D. Adjust time switch settings to achieve desired operation schedule as indicated or as directed by Architect. Record settings in written report to be included with submittals.

E. Adjust external sliding shields on outdoor photo controls under optimum lighting conditions to achieve desired turn-on and turn-off activation as indicated or as directed by Architect.

F. Adjust daylighting controls under optimum lighting conditions after all room finishes, furniture, and window treatments have been installed to achieve desired operation as indicated or as directed by Architect and Owner's Authorized Representative. Record settings in written report to be included with submittals. Readjust controls calibrated prior to installation of final room finishes, furniture, and window treatments that do not function properly as determined by Architect and Owner's Authorized Representative.

3.06 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.07 CLOSEOUT ACTIVITIES

A. See Section 01 77 00 - Closeout Procedures, for closeout submittals and additional demonstration and training requirements.

B. Demonstration: Demonstrate proper operation of lighting control devices to Owner's personnel, and correct deficiencies or make adjustments as directed.

C. Training: Train Owner's personnel on operation, adjustment, programming, and maintenance of lighting control devices.

1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
2. Provide minimum of two hours of training.
3. Instructor: Manufacturer's authorized service representative.
4. Location: At project site.

END OF SECTION

SECTION 26 24 16
PANELBOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Power distribution panelboards.

B. Overcurrent protective devices for panelboards.

1.02 RELATED REQUIREMENTS

A. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

B. Section 26 05 29 - Hangers and Supports for Electrical Systems.

C. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

D. Section 26 05 73 - Overcurrent Protective Device Coordination Study.

E. Section 26 09 14 - Electrical Power Monitoring: Power Monitoring System.

F. Section 26 24 13 - Switchboards.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.

B. NECA 407 - Standard for Installing and Maintaining Panelboards; National Electrical Contractors Association; 2009.

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.

D. NEMA PB 1 - Panelboards; National Electrical Manufacturers Association; 2011.

E. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less; National Electrical Manufacturers Association; 2013.

F. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association; 2013.

G. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

I. UL 67 - Panelboards; Current Edition, Including All Revisions.

J. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

K. UL 869A - Reference Standard for Service Equipment; Current Edition, Including All Revisions.

L. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

M. UL 1053 - Ground-Fault Sensing and Relaying Equipment; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
   2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   3. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted panelboards where indicated.

4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
5. Notify Owner's Representative of any conflicts with or deviations from the contract documents. Obtain direction from Owner before proceeding with work.

1.05 SUBMITTALS

A. See Section 01 3300 for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.

C. Provide data as required to perform power study and arc flash labeling as specified in 26 05 73.

D. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.

E. Project Record Documents: Record actual installed locations of panelboards and actual installed circuiting arrangements.

F. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. Panelboard Keys: Two of each different key.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Products: Provide products listed and classified by Underwriters Laboratories Inc., or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented commercial experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store panelboards in accordance with manufacturer's instructions and NECA 407.

B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle carefully in accordance with manufacturer's written instructions to avoid damage to panelboard internal components, enclosure, and finish.

1.08 FIELD CONDITIONS

A. Maintain ambient temperature within the following limits during and after installation of panelboards:
1. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Siemens Industry, Inc: www.sea.siemens.com.

B. Eaton Corporation; Cutler-Hammer Products: www.eaton.com.

C. General Electric Company: www.geindustrial.com.

D. Square D: www.squared.com. (basis of design)

E. Substitutions: See Section 01 25 00 - Substitution Procedures.

F. Source Limitations: Furnish panelboards and associated components produced by a single manufacturer and obtained from a single supplier.

2.02 ALL PANELBOARDS

A. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
   1. Altitude: Less than 6,600 feet.
   2. Ambient Temperature:
      a. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.

B. Short Circuit Current Rating:
   1. Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 26 05 73.
   2. Listed series ratings are not acceptable.

C. Panelboards Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.

D. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.

E. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.

F. Bussing: Sized in accordance with UL 67 temperature rise requirements.
   1. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
   2. Provide 200 percent rated neutral bus and lugs where indicated, where oversized neutral conductors are provided, or where panelboards are fed from K-rated transformers.
   3. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
   4. Provide separate isolated/insulated ground bus where indicated or where isolated grounding conductors are provided.

G. Conductor Terminations: Suitable for use with the conductors to be installed.

H. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
   1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
      a. Indoor Clean, Dry Locations: Type 1.
   2. Boxes: Galvanized steel unless otherwise indicated.
      a. Provide wiring gutters sized to accommodate the conductors to be installed.
      b. Increase gutter space as required where sub-feed lugs, feed-through lugs, or oversized lugs are provided.
   3. Fronts:
      a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
      b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.
      c. Finish for Painted Steel Fronts: Manufacturer's standard grey unless otherwise indicated.
   4. Lockable Doors: All locks keyed alike unless otherwise indicated.

I. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.

J. Surge Protective Devices: Where factory-installed, internally mounted surge protective devices are provided in accordance with Section 26 43 00, list and label panelboards as a complete assembly including surge protective device.

K. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.
   1. Where electronic circuit breakers equipped with integral ground fault protection are used, provide separate neutral current sensor where applicable.
   2. Where accessory ground fault sensing and relaying equipment is used, equip companion overcurrent protective devices with ground-fault shunt trips.

a. Use zero sequence ground fault detection method unless otherwise indicated.
b. Provide test panel and field-adjustable ground fault pick-up and delay settings.

L. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.

M. Multi-Section Panelboards: Provide enclosures of the same height, with feed-through lugs or sub-feed lugs and feeders as indicated or as required to interconnect sections.

N. Load centers are not acceptable.

O. Provide the following features and accessories where indicated or where required to complete installation:
1. Feed-through lugs.
2. Sub-feed lugs.

2.03 POWER DISTRIBUTION PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, power and feeder distribution type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Conductor Terminations:
1. Main and Neutral Lug Material: Copper, suitable for terminating copper conductors only.
2. Main and Neutral Lug Type: Mechanical.

C. Bussing:
1. Phase and Neutral Bus Material: Copper. Full size
2. Ground Bus Material: Copper. Full Length

D. Enclosures:
1. Provide surface-mounted enclosures unless otherwise indicated.
2. Fronts: Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
3. Provide clear plastic circuit directory holder mounted on inside of door.

E. Panelboard spare capacity:
1. All 120/208 Volt electrical panels shall have 50% spare breaker spaces at the end of construction.
2. All 277/480 Volt electrical panels shall have 30% spare breaker spaces at the end of construction.
3. Spare space means no drilling or threading will be necessary to add circuit breakers.

2.04 OVERCURRENT PROTECTIVE DEVICES

A. Molded Case Circuit Breakers:
1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
2. Interrupting Capacity:
a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating as calculated in power study
b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
3. Conductor Terminations:
a. Provide mechanical lugs unless otherwise indicated.
b. Provide compression lugs where indicated.
c. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.

a. Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 200 amperes and larger.
b. Provide interchangeable trip units for circuit breaker frame sizes 400 amperes and larger.
c. Monitored circuit breakers shall be Square D PowerPact Energy Breakers.

5. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
   a. Provide electronic trip circuit breakers for all breakers size 600 amp and larger and as required by coordination study, Section 26 05 73. See One line diagram and specification section 26 09 14 for Electronic Trip Circuit Breaker requirements for circuit breakers that are being monitored by the power management system.
   b. Provide the following field-adjustable trip response settings:
      1) Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.
      2) Long time delay.
      3) Short time pickup and delay.
      4) Instantaneous pickup.
      5) Ground fault pickup and delay where ground fault protection is indicated.
      6) Zone Selective Interlocking.
6. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.
7. Provide the following circuit breaker types where indicated:
   a. Ground Fault Circuit Interrupter (GFCI) Circuit Breakers: Listed as complying with UL 943, class A for protection of personnel.
   b. Ground Fault Equipment Protection Circuit Breakers: Designed to trip at 30 mA for protection of equipment.
   c. 100 Percent Rated Circuit Breakers: Listed for application within the panelboard where installed at 100 percent of the continuous current rating.
8. Provide listed switching duty rated circuit breakers with SWD marking for all branch circuits serving fluorescent lighting.
9. Provide listed high intensity discharge lighting rated circuit breakers with HID marking for all branch circuits serving HID lighting.
10. Do not use tandem circuit breakers.
11. Do not use handle ties in lieu of multi-pole circuit breakers.
12. Provide multi-pole circuit breakers for multi-wire branch circuits as required by NFPA 70.
13. Provide the following features and accessories where indicated or where required to complete installation:
    a. Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.
    b. Handle Pad-Lock Provision: For locking circuit breaker handle in OFF position.
    c. Auxiliary Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped or been turned off.
    d. Phase Loss Protection on breakers indicated on drawing: For tripping circuit breaker upon phase loss.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that the ratings and configurations of the panelboards and associated components are consistent with the indicated requirements.

B. Verify that mounting surfaces are ready to receive panelboards.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install panelboards securely, in a neat and workmanlike manner in accordance with NECA 1 (general workmanship), NECA 407 (panelboards), and NEMA PB 1.1.

B. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

C. Provide required supports in accordance with Section 26 05 29.

D. Install panelboards plumb.

E. Install flush-mounted panelboards so that trims fit completely flush to wall with no gaps and rough opening completely covered.

F. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches above the floor or working platform.

G. Provide grounding and bonding in accordance with Section 26 05 26.
   1. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on isolated/insulated ground bus.
   2. Terminate branch circuit isolated grounding conductors on isolated/insulated ground bus only. Do not terminate on solidly bonded equipment ground bus.

H. Install all field-installed branch devices, components, and accessories.

I. Multi-Wire Branch Circuits: Group grounded and ungrounded conductors together in the panelboard as required by NFPA 70.

J. Set field-adjustable circuit breaker tripping function settings as determined by overcurrent protective device coordination study performed according to Section 26 05 73.

K. Provide filler plates to cover unused spaces in panelboards.

L. Provide circuit breaker lock-on devices to prevent unauthorized personnel from de-energizing essential loads where indicated. Also provide for the following:
   1. Fire detection and alarm circuits.
   2. Communications equipment circuits.
   3. Intrusion detection and access control system circuits.
   4. Video surveillance system circuits.

M. Identify panelboards in accordance with Section 26 05 53.

N. Provide four spare 3/4 inch conduits from each flush mounted panelboard to accessable ceiling space.
   1. Terminate each conduit into a dedicated 4-square box with cover.

3.03 FIELD QUALITY CONTROL

A. Perform inspection, testing, and adjusting in accordance with Section 01 45 00.

B. Inspect and test in accordance with NETA STD ATS, except Section 4.

C. Molded Case Circuit Breakers: Perform inspections and tests listed in NETA STD ATS, Section 7.6.1.1 for all main circuit breakers. Tests listed as optional are not required.

D. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.

E. Test GFCI circuit breakers to verify proper operation.

F. Test shunt trips to verify proper operation.

G. Correct deficiencies and replace damaged or defective panelboards or associated components.

H. Perform inspections and tests listed in NETA STD ATS, Section 7.5 for switches, Section 7.6 for circuit breakers.

3.04 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

B. Adjust alignment of panelboard fronts.

C. Load Balancing: For each panelboard, rearrange circuits such that the difference between each measured steady state phase load does not exceed 20 percent and adjust circuit directories accordingly. Maintain proper phasing for multi-wire branch circuits.

3.05 CLEANING

A. Clean dirt and debris from panelboard enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 26 27 17
EQUIPMENT WIRING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical connections to equipment.

B. Electrical connections to motors furnished under Division 23 and Divsiion 26.

1.02 RELATED REQUIREMENTS

A. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.

B. Section 23 05 13 - Common Motor Requirements for HVAC Equipment

C. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables (600 V and Less).

D. Section 26 05 34 - Conduit.

E. Section 26 05 37 - Boxes.

F. Section 26 28 18 - Enclosed Switches.

G. Section 26 29 23 - Variable Frequency Motor Controllers (Installation)

1.03 REFERENCE STANDARDS

A. NEMA WD 1 - General Color Requirements for Wiring Devices; National Electrical Manufacturers Association; 1999 (R 2010).

B. NEMA WD 6 - Wiring Devices - Dimensional Requirements; National Electrical Manufacturers Association; 2012.

C. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.
   2. Determine connection locations and requirements.

B. Sequencing:
   1. Install rough-in of electrical connections before installation of equipment is required.
   2. Make electrical connections before required start-up of equipment.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide wiring device manufacturer’s catalog information showing dimensions, configurations, and construction.

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Products: Listed, classified, and labeled as suitable for the purpose intended.

PART 2 PRODUCTS

2.01 MATERIALS

A. Cords and Caps: NEMA WD 6; match receptacle configuration at outlet provided for equipment.
   1. Colors: Conform to NEMA WD 1.

2. Cord Construction: NFPA 70, Type SO, multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.
3. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.

B. Disconnect Switches: As specified in Section 26 28 18 and in individual equipment sections.

C. Flexible Conduit: As specified in Section 26 05 34.

D. Wire and Cable: As specified in Section 26 05 19.

E. Boxes: As specified in Section 26 05 37.

2.02 EQUIPMENT CONNECTIONS

A. Equipment connection shall be according to NEC and 2010 Oreogn Electircla Speciality Code.:
1. Electrical Connection: Flexible conduit.
2. Electrical Connection: Cord and plug (NEMA 6-20R).
3. Provide field-installed disconnect switch as required by NEC or drawings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that equipment is ready for electrical connection, wiring, and energization.

3.02 ELECTRICAL CONNECTIONS

A. Make electrical connections in accordance with equipment manufacturer's instructions.

B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.

C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.

D. Provide receptacle outlet to accommodate connection with attachment plug.

E. Provide cord and cap where field-supplied attachment plug is required.

F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.

G. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.

H. Install terminal block jumpers to complete equipment wiring requirements.

I. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

END OF SECTION

SECTION 26 27 26
WIRING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall switches.

B. Wall dimmers.

C. Fan speed controllers.

D. Receptacles.

E. Wall plates.

F. Floor box service fittings.

1.02 RELATED REQUIREMENTS

A. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

B. Section 26 05 37 - Boxes.

C. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

D. Section 27 10 05 - Structured Telecommunications Cabling and Enclosures: Products.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.

B. NEMA WD 1 - General Color Requirements for Wiring Devices; National Electrical Manufacturers Association; 1999 (R 2010).

C. NEMA WD 6 - Wiring Device -- Dimensional Requirements; National Electrical Manufacturers Association; 2012.

D. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

F. UL 1472 - Solid-State Dimming Controls; Current Edition, Including All Revisions.

G. UL 1917 - Solid-State Fan Speed Controls; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.
   2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.
   3. Coordinate the placement of outlet boxes for wall switches with actual installed door swings.
   4. Notify Owner's Representative of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

B. Sequencing:
   1. Do not install wiring devices until final surface finishes and painting are complete.

1.05 SUBMITTALS

A. See Section 01 3300 for submittal procedures.

B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.
   1. Wall Dimmers: Include derating information for ganged multiple devices.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Products: Listed and classified by Underwriters Laboratories Inc. or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented commercial experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Hubbell Incorporated: www.hubbell-wiring.com.

B. Leviton Manufacturing Company, Inc: www.leviton.com.

C. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us

D. Substitutions: See Section 01 25 00 - Substitution Procedures.

2.02 WALL SWITCHES

A. Standard Wall Switches: Industrial specification grade, 20 A, 120/277 V with standard toggle type switch actuator and maintained contacts; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

2.03 WALL DIMMERS

A. All Wall Dimmers: Solid-state with continuous full-range even control following square law dimming curve, integral radio frequency interference filtering, power failure preset memory, air gap switch accessible without removing wall plate, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 1472; types and ratings suitable for load controlled as indicated on the drawings.

B. Incandescent Wall Dimmers: 120 V AC, slide control type with separate on/off switch; single pole or three way as indicated on the drawings.
   1. Power Rating: 600 W unless otherwise indicated or required to control the load indicated on the drawings.

C. Magnetic Low-Voltage Wall Dimmers: 120 V AC, slide control type with separate on/off switch; single pole or three way as indicated on the drawings.
   1. Power Rating: 600 VA unless otherwise indicated or required to control the load indicated on the drawings.

D. Electronic Low-Voltage Wall Dimmers: 120 V AC, slide control type with separate on/off switch; single pole or three way as indicated on the drawings.
   1. Power Rating: 400 VA unless otherwise indicated or required to control the load indicated on the drawings.

E. Fluorescent Wall Dimmers: 120 V AC, slide control type with separate on/off switch, compatible with dimming ballast controlled; single pole or three way as indicated on the drawings.
   1. Power Rating: 600 VA unless otherwise indicated or required to control the load indicated on the drawings.

F. Provide accessory wall switches to match dimmer appearance when installed adjacent to each other.

2.04 FAN SPEED CONTROLLERS

A. Description: 120 V AC, solid-state, full-range variable speed, slide control type with separate on/off switch, with integral radio frequency interference filtering, fan hum elimination circuitry, field-adjustable trim, power failure preset memory, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 1917.

2.05 RECEPTACLES

A. All Receptacles: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types as indicated on the drawings.

1. NEMA configurations specified are according to NEMA WD 6.

B. Convenience Receptacles:
   1. Standard Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.
   2. Isolated Ground Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, with ground contacts isolated from mounting strap; single or duplex as indicated on the drawings.

C. GFI Receptacles:
   1. All GFI Receptacles: Provide with feed-through protection, light to indicate ground fault tripped condition and loss of protection, and list as complying with UL 943, class A.
      a. Provide test and reset buttons of same color as device.
      b. Standard GFI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.
      c. Weather Resistant GFI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations.
   2. Locking Receptacles: Industrial specification grade, configuration as indicated on the drawings.

D. See Section 27 10 05 for Product Requirements.

E. Color: Ivory. Receptacles connected to standby distribution system: Red.

2.06 DATA OUTLETS

A. See Section 27 10 05 for Product Requirements.
   1. Color: Orange

2.07 WALL PLATES

A. Manufacturers:
   1. Hubbell Incorporated: www.hubbell-wiring.com.
   2. Leviton Manufacturing Company, Inc: www.leviton.com.
   3. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us
   4. Substitutions: See Section 01 25 00 - Product Substitution Procedures.

B. All Wall Plates: Comply with UL 514D.
   1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
   2. Size: Standard.
   3. Screws: Metal with slotted heads finished to match wall plate finish.

C. Nylon Wall Plates: Smooth finish, high-impact thermoplastic. Provide color as directed by architect.

D. Weatherproof Cover Plates: Gasketed cast metal with hinged "bubble" cover that allows plug in receptacle while cover is closed.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

B. Verify that wall openings are neatly cut and will be completely covered by wall plates.

C. Verify that final surface finishes are complete, including painting.

D. Verify that floor boxes are adjusted properly.

E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

F. Verify that openings in access floor are in proper locations.

G. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Perform work in a neat and workmanlike manner in accordance with NECA 1 and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Coordinate locations of outlet boxes provided under Section 26 05 37 as required for installation of wiring devices provided under this section.
   1. Mounting Heights: Unless otherwise indicated, as follows:
      a. Wall Switches: 46 inches above finished floor.
      b. Wall Dimmers: 46 inches above finished floor.
      c. Receptacles: 18 inches above finished floor or 6 inches above counter.
         1) Where multiple receptacles, wall switches, or wall dimmers are installed at the same location and at the same mounting height, gang devices together under a common wall plate.
      d. Locate receptacles for electric drinking fountains concealed behind drinking fountain according to manufacturer's instructions.

C. Install wiring devices in accordance with manufacturer's instructions.

D. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

E. Where required, connect wiring devices using pigtails not less than 6 inches long. Do not connect more than one conductor to wiring device terminals.

F. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer or use pressure plate with screw tightened to proper torque.

G. Do not use push-in pressure terminals that do not rely on screw-actuated binding.

H. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

I. For isolated ground receptacles, connect wiring device grounding terminal only to identified branch circuit isolated equipment grounding conductor. Do not connect grounding terminal to outlet box or normal branch circuit equipment grounding conductor.

J. Provide GFI receptacles with integral GFI protection at each location indicated. Do not use feed-through wiring to protect downstream devices.

K. Install wiring devices plumb and level with mounting yoke held rigidly in place.

L. Install wall switches with OFF position down.

M. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.

N. Do not share neutral conductor on branch circuits utilizing wall dimmers.

O. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.

P. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

Q. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.

R. Install receptacles with grounding pole on bottom.

S. Connect wiring device grounding terminal to outlet box with bonding jumper.

T. Provide neoprene or similar gasket for all exterior devices to minimize air infultration.

U. Install wall switch 46 inches above finished floor unless noted otherwise.

V. Install convenience receptacle 18 inches above finished floor unless noted otherwise.

W. Install telephone jack 18 inches above finished floor unless noted otherwise.

3.04 FIELD QUALITY CONTROL

A. Perform field inspection, testing, and adjusting in accordance with Section 01 45 00.

B. Inspect each wiring device for damage and defects.

C. Operate each wall switch and wall dimmer with circuit energized to verify proper operation.

D. Test each receptacle to verify operation and proper polarity.

E. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.

F. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.05 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

B. Adjust presets for wall dimmers according to manufacturer's instructions as directed by Owner's Representative.

3.06 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION

SECTION 26 28 17
ENCLOSED CIRCUIT BREAKERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Enclosed circuit breakers.

1.02 RELATED REQUIREMENTS

A. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

B. Section 26 05 29 - Hangers and Supports for Electrical Systems.

C. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

D. Section 26 05 73 - Overcurrent Protective Device Coordination Study.

1.03 REFERENCE STANDARDS

A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; Federal Specification; Revision E, 2013.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.

C. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

E. UL 1053 - Ground-Fault Sensing and Relaying Equipment; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.
   2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   3. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted enclosed circuit breakers where indicated.
   4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
   5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 01 3300 for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for circuit breakers, enclosures, and other installed components and accessories.

C. Project Record Documents: Record actual installed locations of enclosed circuit breakers.

D. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented commercial experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Siemens Industry, Inc: www.sea.siemens.com.

B. Eaton Corporation; Cutler-Hammer Products: www.eaton.com.

C. General Electric Company: www.geindustrial.com.

D. Schneider Electric; Square D Products: www.schneider-electric.us.

E. Substitutions: See Section 01 25 00 - Substitution Procedures.

F. Source Limitations: Furnish enclosed circuit breakers and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.02 ENCLOSED CIRCUIT BREAKERS

A. Description: Units consisting of molded case circuit breakers individually mounted in enclosures.

B. Provide products listed and labeled by testing firm acceptable to the authority having jurisdiction as suitable for the purpose indicated.

C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
   1. Altitude: Less than 6,600 feet.
   2. Ambient Temperature: Between 23 degrees F and 104 degrees F.

D. Short Circuit Current Rating:
   1. Provide enclosed circuit breakers with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 26 05 73.

E. Conductor Terminations: Suitable for use with the conductors to be installed.

F. Provide thermal magnetic circuit breakers unless otherwise indicated.

G. Provide electronic trip circuit breakers as required by power study to coordinate. See Section 26 14 09 for requirements for enclosed circuit breaker with power monitoring at generator.

H. Provide insulated, groundable fully rated solid neutral assembly where a neutral connection is required, with a suitable lug for terminating each neutral conductor.

I. Provide solidly bonded equipment ground bus in each enclosed circuit breaker, with a suitable lug for terminating each equipment grounding conductor.

J. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
   1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
      a. Indoor Clean, Dry Locations: Type 1.
      b. Outdoor Locations: Type 3R.
   2. Finish for Painted Steel Enclosures: Manufacturer's standard, factory applied grey unless otherwise indicated.
   3. Provide surface-mounted enclosures unless otherwise indicated.

K. Provide externally operable handle with means for locking in the OFF position.

L. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.

M. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that the ratings of the enclosed circuit breakers are consistent with the indicated requirements.

B. Verify that mounting surfaces are ready to receive enclosed circuit breakers.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install enclosed circuit breakers where indicated, in accordance with manufacturer's instructions.

B. Install enclosed circuit breakers securely, in a neat and workmanlike manner in accordance with NECA 1.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide required supports in accordance with Section 26 05 29.

E. Install enclosed circuit breakers plumb.

F. Install flush-mounted enclosed circuit breakers so that trims fit completely flush to wall with no gaps and rough opening completely covered.

G. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed circuit breakers such that the highest position of the operating handle does not exceed 79 inches above the floor or working platform.

H. Provide grounding and bonding in accordance with Section 26 05 26.

I. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.

J. Set field-adjustable circuit breaker tripping function settings as determined by overcurrent protective device coordination study performed according to Section 26 05 73.

K. Identify enclosed circuit breakers in accordance with Section 26 05 53.

3.03 FIELD QUALITY CONTROL

A. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.

B. Test shunt trips to verify proper operation.

C. Correct deficiencies and replace damaged or defective enclosed circuit breakers.

3.04 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.05 CLEANING

A. Clean dirt and debris from circuit breaker enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 26 28 18
ENCLOSED SWITCHES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Enclosed safety switches.

1.02 RELATED REQUIREMENTS

A. Section 26 05 29 - Hangers and Supports for Electrical Systems.

B. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

C. Section 26 29 13 - Enclosed Controllers: Manual motor controllers.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.

B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); National Electrical Manufacturers Association; 2014.

C. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); National Electrical Manufacturers Association; 2013.

D. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; International Electrical Testing Association; 2013 (ANSI/NETA ATS).

E. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

G. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

H. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for enclosed switches and other installed components and accessories.

1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Products: Listed and classified by Underwriters Laboratories Inc. or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Eaton Corporation; _____: www.eaton.com.

B. General Electric Company; _____: www.geindustrial.com.

C. Square D: www.squared.com.

D. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ENCLOSED SAFETY SWITCHES

A. Description: Quick-make, quick-break enclosed safety switches listed and labeled as complying with UL 98; heavy duty; ratings, configurations, and features as indicated on the drawings.

B. Horsepower Rating: Suitable for connected load.

C. Voltage Rating: Suitable for circuit voltage.

D. Short Circuit Current Rating:
   1. Minimum Ratings:
      a. Heavy Duty Single Throw Switches Protected by Class R, Class J, Class L, or Class T Fuses: 200,000 rms symmetrical amperes.

E. Provide with switch blade contact position that is visible when the cover is open.

F. Fuse Clips for Fusible Switches: As required to accept fuses indicated.
   1. Where NEMA Class R fuses are installed, provide rejection feature to prevent installation of fuses other than Class R.

G. Conductor Terminations: Suitable for use with the conductors to be installed.

H. Provide insulated, groundable fully rated solid neutral assembly where a neutral connection is required, with a suitable lug for terminating each neutral conductor.

I. Provide solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.

J. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
   1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
      a. Indoor Clean, Dry Locations: Type 1.
      b. Outdoor Locations: Type 3R.
   2. Finish for Painted Steel Enclosures: Manufacturer's standard, factory applied grey unless otherwise indicated.

K. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.

L. Heavy Duty Switches:
   1. Comply with NEMA KS 1.
   2. Conductor Terminations:
      a. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
   3. Provide externally operable handle with means for locking in the OFF position, capable of accepting three padlocks.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that the ratings of the enclosed switches are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive enclosed safety switches.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install enclosed switches in accordance with manufacturer's instructions.

B. Install enclosed switches securely, in a neat and workmanlike manner in accordance with NECA 1.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide required supports in accordance with Section 26 05 29.

E. Install enclosed switches plumb.

F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 79 inches above the floor or working platform.

G. Provide fuses for fusible switches as indicated or as required by equipment manufacturer's recommendations.

H. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.

I. Identify enclosed switches in accordance with Section 26 05 53.

J. Install fuses in fusible disconnect switches sized to protect the load being served.

K. Apply adhesive tag on inside door of each fused switch indicating NEMA fuse class and size installed.

3.03 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.04 CLEANING

A. Clean dirt and debris from switch enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 26 29 13
ENCLOSED CONTROLLERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Manual motor controllers.

B. Magnetic motor controllers.

C. Combination magnetic motor controllers and disconnects.

1.02 RELATED REQUIREMENTS

A. Section 26 05 29 - Hangers and Supports for Electrical Systems.

B. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.

B. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts; National Electrical Manufacturers Association; 2000 (R2005), with errata, 2008.

C. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices; National Electrical Manufacturers Association; 2000 (R2010).

D. NEMA ICS 6 - Industrial Control and Systems: Enclosures; National Electrical Manufacturers Association; 1993 (R2006).

E. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide catalog sheets showing voltage, controller size, ratings and size of switching and overcurrent protective devices, short circuit ratings, dimensions, and enclosure details.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Eaton Corporation; Cutler-Hammer Product: www.eaton.com.

B. General Electric Company: www.geindustrial.com.

C. Schneider Electric; Square D Products: www.schneider-electric.us.

D. Siemens Industry, Inc: www.sea.siemens.com.

E. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 MANUAL CONTROLLERS

A. Manual Motor Controllers: NEMA ICS 2, AC general-purpose, Class A, manually operated, full-voltage controller with overload element, and toggle operator.

2.03 AUTOMATIC CONTROLLERS

A. Magnetic Motor Controllers: NEMA ICS 2, AC general-purpose Class A magnetic controller for induction motors rated in horsepower.

B. Coil Operating Voltage: 120 volts, 60 Hertz.

C. Overload Relays: NEMA ICS 2; bimetal.

D. Enclosures: NEMA ICS 6, Type 1.

2.04 ACCESSORIES

A. Auxiliary Contacts: NEMA ICS 2, 2 normally open contacts in addition to seal-in contact.

B. Cover Mounted Pilot Devices: NEMA ICS 5, standard duty oiltight type.

C. Pilot Device Contacts: NEMA ICS 5, Form Z, rated A150.

D. Pushbuttons: Unguarded type.

E. Indicating Lights: Transformer, LED type.

F. Selector Switches: Rotary type.

2.05 DISCONNECTS

A. Combination Controllers: Combine motor controllers with disconnects in common enclosure. Obtain IEC Class 2 coordinated component protection.

B. Motor Circuit Protector: Circuit breakers with integral instantaneous magnetic trip in each pole; UL listed.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install enclosed controllers where indicated, in accordance with manufacturer's instructions.

B. Install securely, in a neat and workmanlike manner, as specified in NECA 1.

C. Provide supports in accordance with Section 26 05 29.

D. Select and install overload heater elements in motor controllers to match installed motor characteristics.

E. Identify enclosed controllers in accordance with Section 26 05 53.

3.02 FIELD QUALITY CONTROL

END OF SECTION

SECTION 26 29 23

VARIABLE-FREQUENCY MOTOR CONTROLLERS (INSTALLATION)

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Variable frequency controller installation.

1.02 RELATED REQUIREMENTS

A. Products and Execution defined in this Section shall be commissioned. Refer to Sections 23 08 00 and 01 91 13 for scope of work and responsibilities related to commissioning.

B. Section 23 05 15 - Variable Frequency Drives.

C. Section 26 05 34 - Conduit.

D. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS

A. NEMA ICS 7.1 - Safety Standards for Construction and Guide for Selection, Installation, and Operation of Adjustable Speed Drive Systems; National Electrical Manufacturers Association; 2006.

B. NEMA ICS 7 - Industrial Control and Systems: Adjustable-Speed Drives; National Electrical Manufacturers Association; 2006.

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); National Electrical Manufacturers Association; 2014.

D. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; International Electrical Testing Association; 2013 (ANSI/NETA ATS).

E. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide catalog sheets showing voltage, controller size, ratings and size of switching and overcurrent protective devices, short circuit ratings, dimensions, and enclosure details.

C. Product Data: Provide catalog sheets for VFD cable and cable fittings.

1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience and with service facilities within 100 miles of Project.

C. Products: Listed, classified, and labeled as suitable for the purpose intended.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to components, enclosure, and finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Reliance Electric/Rockwell Automation: www.reliance.com.

B. Siemens Energy & Automation: www.sea.siemens.com.

C. Schneider Electric; Square D Products: www.schneider-electric.us.

D. Okonite (Oko) type C-L-X cable.

E. Southwire (SW) type HLX01XXH ARMOR-X

F. Crouse Hinds (CH) fittings

G. Thomas & Betts (T&B) fittings

H. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 DESCRIPTION

A. Variable Frequency Controllers: Enclosed controllers suitable for operating the indicated loads, in conformance with requirements of NEMA ICS 7. Select unspecified features and options in accordance with NEMA ICS 3.1.
   1. Employ microprocessor-based inverter logic isolated from power circuits.
   2. Employ pulse-width-modulated inverter system.
   3. Design for ability to operate controller with motor disconnected from output.
   4. Design to attempt five automatic restarts following fault condition before locking out and requiring manual restart.

B. Variable Frequency Controllers are purchased by Division 23 to match motor selection. Division 26 is responsible for installation as described in Section 26 29 23.

C. VFD Cable:
   1. Continuously welded, corrugated aluminum armor.
   2. High dielectric strength, thermoset wire insulation.
   3. Insulating outer jacket.
   4. Symetrical wiring technology with three power wires and three grounds.
   5. MC-HL listed.

D. VFC Cable fittings:
   1. Utilize fittings as recommended by manufacturer.

E. Typical cable catalog numbers and associated fittings (verify w/manufacturer). Provide size listed below corresponding to the variable frequency drive horsepower rating indicated on the mechanical equipment schedules. Provide conduit raceway as indicated.
   1. 230V 0.5-3HP & 460V 0.5-7.5HP: 14 AWG Oko #546-31-3403 or SW #HLX01-XXH-14/3/P w/ CH #TMC165 or T&B #STE050 in 1-1/4" EMT or PVC.
   2. 230V 5HP & 460V 10HP: 12 AWG Oko #546-31-3453 or SW #HLX01-XXH-12/3/P w/ CH #TMC165 or T&B #STE050 in 1-1/4" EMT or Sch 40 PVC or 1-1/2" Sch 80 PVC.
   3. 230V 7.5HP & 460V 15HP: 10 AWG Oko #546-31-3503 or SW #HLX01-XXH-10/3/P w/ CH #TMC165 or T&B #STE050 in 1-1/4" EMT or Sch 40 PVC or 1-1/2" Sch 80 PVC
   4. 230V 10-15HP & 460V 20-30HP: 8 AWG Oko #571-31-3190 or SW #HLX01-XXH-8/3 w/ CH #TMC285 or T&B #STE050 in 1-1/2" EMT or PVC.
   5. 230V 20HP & 460V 40HP: 6 AWG Oko #571-31-3191 or SW #HLX01-XXH-6/3 w/ CH #TMC2852 or T&B #STE050 in 1-1/2" EMT or PVC.
   6. 230V 25HP & 460V 50HP: 4 AWG Oko #571-31-3200 or SW #HLX01-XXH-4/3 w/ CH #TMC3112 or T&B #STE075 in 1-1/2" EMT or Sch 40 PVC or 2" Sch 80 PVC.
   7. 230V 30-40HP & 460V 60-75HP: 2 AWG Oko #571-31-3204 or SW #HLX01-XXH-2/3 w/ CH #TMC3112 or T&B #STE075 in 2" EMT or PVC.
   8. 230V 50HP & 460V 100HP: 1/0 AWG Oko #571-31-3213 or SW #HLX01-XXH-010/3 w/ CH #TMC4140 or T&B #STE125 in 2" EMT or PVC.
   9. 230V 60HP & 460V 125HP: 2/0 AWG Oko #571-31-3216 or SW #HLX01-XXH-020/3 w/ CH #TMC5161 or T&B #STE125 in 2" EMT or PVC.
   10. 230V 75HP & 460V 150HP: 4/0 AWG Oko #571-31-3224 or SW #HLX01-XXH-040/3 w/ CH #TMC6206 or T&B #STE150 in 2" EMT or Sch 40 PVC or 2-1/2" Sch 80 PVC.
   11. 230V 100HP & 460V 200HP: 350 MCM Oko #571-31-3236 or SW #HLX01-XXH-250/3 w/ CH #TMC6206 or T&B #STE200 in 2-1/2" EMT or PVC.

12. Feeder lengths longer than 10-times the voltage shall use the next larger cable size.

F. Variable Frequency Drive (VFD) disconnect switch by Hubbel to be installed between drive and motor.

G. Enclosures: NEMA 250, Type 1, suitable for equipment application in places regularly open to the public.

H. Finish: Manufacturer's standard enamel.

2.03 OPERATING REQUIREMENTS

A. Rated Input Voltage: 480 volts, three phase, 60 Hertz.

B. Motor Nameplate Voltage: 460 volts, three phase, 60 Hertz.

C. Displacement Power Factor: Between 1.0 and 0.95, lagging, over entire range of operating speed and load.

D. Operating Ambient: 0 degrees C to 40 degrees C.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surface is suitable for controller installation.

B. Verify that controller is sized for the motor being operated.

C. Do not install controller until building environment can be maintained within the service conditions required by the manufacturer.

D. Verify that field measurements are as instructed by manufacturer.

3.02 INSTALLATION

A. Install in accordance with NEMA ICS 7.1 and manufacturer's instructions.

B. Line and Load conductors shall not be routed in the same conduit.

C. Wiring requirement for motors with VFD's:
1. Conduit/cable lengths shall be kept as short as possible.
2. Flexible metal conduit lengths shall not exceed 6 feet. Prefer no longer than 24 inches.
3. Control wiring running parallel to motor feeders shall have a separation of 20 inches, minimum.
4. Provide conduit raceway from electrical panel to within 4-ft of VFD. Provide ground bushing on metal conduits at electric panel. Provide "bell" or busing on conduit end by VFD.
5. Provide conduit raceway from VFD to Motor, ending conduit within 4-ft of VFD and Motor. Metal conduits shall have a grounding bushing on one end, grounded with #6 AWG wire to the electrical panel ground bar. Provide bell or bushing on each end of conduit.
6. Conduit sizes shall be as indicated in this specification unless indicated otherwise on the drawings.
7. Unless directed otherwise by manufacturer, contractor shall pull cable into conduit with "chinese finger" cable grip, sized for the diameter of the cable.
8. Do not exceed VFD cable manufacturer listed bending radius.
9. Provide VFD cable manufacturer recommened cable fittings.
10. When shaft grounding devices are installed on motors (supplied by Division 23), provide ground wire to shaft grounding device. Size wire according to manufacturer instructions. Minimum ground wire size shall be #6 copper. Route and secure ground wire to prevent damage during motor operation and maintenance.

D. Tighten accessible connections and mechanical fasteners after placing controller.

E. Identify variable frequency controllers in accordance with Section 26 05 53.

3.03 FIELD QUALITY CONTROL

A. Start-up and programming is responsibilty of Division 23.

B. Perform field inspection and testing in accordance with Section 01 40 00.

C. Perform inspections and tests listed in NETA ATS, Section 7.17.

D. Perform inspections and feeder resistance/meggar tests listed in NETA ATS, Section 7.17.

3.04 ADJUSTING

A. Assist Division 23 personnel with start-up.

B. Verify voltage at VFD line side termination matches VFD and motor ratings.

END OF SECTION

SECTION 26 36 00
TRANSFER SWITCHES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Automatic Transfer Switch.

1.02 RELATED REQUIREMENTS

A. Section 26 32 13 - Engine Generators: Testing.

1.03 REFERENCE STANDARDS

A. NEMA ICS 10 - Industrial Control and Systems: AC Transfer Switch Equipment; National Electrical Manufacturers Association; 2005.

B. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association; 2013.

C. NFPA 70 - National Electrical Code; National Fire Protection Association; ; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. NFPA 110 - Standard for Emergency and Standby Power Systems; National Fire Protection Association; 2005.

1.04 SUBMITTALS

A. See Section 01 3300 for submittal procedures.

B. Product Data: Provide catalog sheets showing voltage, switch size, ratings and size of switching and overcurrent protective devices, operating logic, short circuit ratings, dimensions, and enclosure details.

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

D. Operation Data: Instructions for operating equipment under emergency conditions when engine generator is running.

E. Maintenance Data: Routine preventative maintenance and lubrication schedule. List special tools, maintenance materials, and replacement parts.

1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented commercial experience and with service facilities within 100 miles of Project.

C. Supplier Qualifications: Authorized distributor of specified manufacturer with minimum three years documented commercial experience.

D. Products: Listed and classified by Underwriters Laboratories Inc. or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.06 MAINTENANCE SERVICE

A. As part of warranty, provide service and maintenance of transfer switches for one year from Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. ASCO Power Technologies, LP: www.asco.com.

B. Eaton Corporation; Cutler-Hammer Products: www.eaton.com.

C. Russelectric: www.russelectric.com.

D. Square D (Schneider Electric)

E. Zenith (General Electric)

F. Siemens

G. Cummins

H. Substitutions: See Section 01 25 00 - Product Substitution Procedures.

2.02 AUTOMATIC TRANSFER SWITCH

A. Description: NEMA ICS 10, automatic transfer switch.

B. Configuration: Electrically operated, mechanically held transfer switch.

C. Ampacity: 800 amp, 4 Pole Standby Branch switch; 125 amp 4 Pole Emergency Branch Switch.

D. Voltage: 277/480 volt 3 phase

E. Interrupting Capacity: 100 percent of continuous rating.

F. Withstand Current Rating: 20,000 rms symmetrical amperes, when used with molded case circuit breaker.

2.03 SERVICE CONDITIONS

A. Service Conditions: NEMA ICS 10.

B. Altitude: 300 feet.

2.04 COMPONENTS

A. LED Indicating Lights: Mount in cover of enclosure to indicate NORMAL SOURCE AVAILABLE, ALTERNATE SOURCE AVAILABLE, and SWITCH POSITION.

B. Test Switch: Mount in cover of enclosure to simulate failure of normal source.

C. Return to Normal Switch: Mount in cover of enclosure to initiate manual transfer from alternate source to normal source.

D. Transfer Switch Auxiliary Contacts: 2 normally open; 2 normally closed.

E. Normal Source Monitor: Monitor each line of normal source voltage and frequency; initiate transfer when voltage drops below 85 percent or frequency varies more than 3 percent from rated nominal value.

F. Alternate Source Monitor: Monitor alternate source voltage and frequency; inhibit transfer when voltage is below 85 percent or frequency varies more than 3 percent from rated nominal value.

G. Enclosure: ICS 10, Type 1, finished with manufacturer's standard gray enamel.

2.05 AUTOMATIC SEQUENCE OF OPERATION

A. Initiate Time Delay to Start Alternate Source Engine Generator: Upon initiation by normal source monitor.

B. Time Delay To Start Alternate Source Engine Generator: 0 to 30 seconds, adjustable. Set at 3 seconds.

C. Initiate Transfer Load to Alternate Source: Upon initiation by normal source monitor and permission by alternate source monitor.

D. Time Delay Before Transfer to Alternate Power Source: Set at 0 seconds for emergency transfer switch, 10 seconds for standby power transfer switch.

E. Maximim time to transfer from Normal Source to Alternate Power Source: 10 seconds.

F. Initiate Retransfer Load to Normal Source: Upon permission by normal source monitor.

G. Time Delay Before Transfer to Normal Power: 10 minutes for emergency switch, 15 minutes for standby power switch.

H. Time Delay Before Engine Shut Down: 0 to 30 minutes, adjustable, of unloaded operation. Set at 5 minutes.

I. Engine Exerciser: Start engine every 30 days; run for 30 minutes under load before shutting down. Bypass exerciser control if normal source fails during exercising period.

J. Retransfer to Normal: Synchronize with normal power and "Make Before Break" retransfer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surface is suitable for transfer switch installation.

3.02 INSTALLATION

A. Provide engraved plastic nameplates under the provisions of Section 26 05 53.

3.03 FIELD QUALITY CONTROL

A. Notify owner a minimum of 7 days prior to testing. All tests shall be witnessed by owner or owner's representative.

B. Provide the services of the manufacturer's technical representative to check out transfer switch connections and operation and place in service.

C. Perform field inspection and testing in accordance with Section 01 45 00.

D. Perform inspections and tests listed in NETA STD ATS, Section 7.22.3.

3.04 CLOSEOUT ACTIVITIES

A. Demonstrate operation of transfer switch in normal, and emergency modes.

3.05 MAINTENANCE

A. As part of warranty, provide service and maintenance of transfer switches for one year from Date of Substantial Completion.

END OF SECTION

SECTION 26 51 00

INTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interior luminaires.

B. Emergency lighting units.

C. Ballasts.

D. Fluorescent dimming ballasts and controls.

E. Lamps.

F. Luminaire accessories.

1.02 RELATED REQUIREMENTS

A. Section 26 05 37 - Boxes.

B. Section 26 27 26 - Wiring Devices: Manual wall switches and wall dimmers.

C. Section 26 56 00 - Exterior Lighting.

1.03 REFERENCE STANDARDS

A. ANSI C78.379 - American National Standard for Electric Lamps -- Reflector Lamps -- Classification of Beam Patterns; 2006.

B. ANSI C82.1 - American National Standard for Lamp Ballast - Line Frequency Fluorescent Lamp Ballast; 2004.

C. ANSI C82.4 - American National Standard for Ballasts for High-Intensity-Discharge and Low Pressure Sodium Lamps (Multiple-Supply Type); 2002.

D. ANSI C82.11 - American National Standard for Lamp Ballasts - High Frequency Fluorescent Lamp Ballasts - Supplements; 2011.

E. IEEE C62.41.2 - Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits; 2002 (R2008).

F. NECA 1 - Standard for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; 2010.

G. NECA/IESNA 500 - Standard for Installing Indoor Commercial Lighting Systems; National Electrical Contractors Association; 2006.

H. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems; National Electrical Contractors Association; 2006.

I. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; National Electrical Manufacturers Association; 2012.

J. NEMA WD 6 - Wiring Devices - Dimensional Requirements; National Electrical Manufacturers Association; 2012.

K. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

L. NFPA 101 - Code for Safety to Life from Fire in Buildings and Structures; National Fire Protection Association; 2012.

M. UL 935 - Fluorescent-Lamp Ballasts; Current Edition, Including All Revisions.

N. UL 1598 - Luminaires; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.
2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
3. Coordinate the placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility installed under other sections or by others.
4. Notify Engineer and Owner's Authorized Representative of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

A. See Section 01 3300 for submittal procedures.

B. Shop Drawings: Indicate dimensions and components for each fixture that is not a standard product of the manufacturer.

C. Product Data: Provide dimensions, ratings, and performance data including luminaire efficiency.

D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

E. Operation and Maintenance Data: Instructions for each product including information on replacement parts.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented commercial experience.

C. Products: Listed and classified by Underwriters Laboratories Inc. or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.07 DELIVERY, STORAGE, AND PROTECTION

A. Receive, handle, and store products according to manufacturer's written instructions.

B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.08 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.09 WARRANTY

A. See Section 01 7700 – Closeout Procedures, for additional warranty requirements.

B. Provide manufacturer warranty for all linear fluorescent ballasts for five years from Date of Substantial Completon.

C. Warrant lamps for 2-1/2 years.

1.10 EXTRA MATERIALS

A. Furnish two of each plastic lens type.

B. Furnish six replacement lamps for each lamp type.

C. Furnish two of each ballast type.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. As specified on drawings.

B. Substitutions: See Section 01 25 00 - Substitution Procedures.

2.02 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

B. Substitutions: See Section 01 25 00 - Substitution Procedures.

2.03 LUMINAIRES

A. Provide products that comply with requirements of NFPA 70.

B. Provide products that are listed and labeled as complying with UL 1598, where applicable.

C. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

D. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.

E. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

F. Recessed Luminaires:
   1. Ceiling Compatibility: Comply with NEMA LE 4.
   2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.
   3. Air-Handling Recessed Fluorescent Luminaires: Suitable for air supply/return, heat removal, or combination as indicated.

G. Fluorescent Luminaires:
   1. Provide ballast disconnecting means complying with NFPA 70 where required.
   2. Provide dual-element, slow-blow fuse on each ballast.
   3. Fluorescent Luminaires Controlled by Occupancy Sensors: Provide programmed start ballasts.
   4. Fluorescent Luminaires Controlled by Dual-Level Switching: Provide with two ballasts.
      a. Luminaires with Four Lamps: One ballast controls two outer lamps and one ballast controls two inner lamps.

2.04 EXIT SIGNS

A. All Exit Signs: Internally illuminated with LEDs unless otherwise indicated; complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.
   1. Number of Faces: Single or double as indicated or as required for the installed location.
   2. Directional Arrows: As indicated or as required for the installed location.
   3. Edge-lit.

B. Manufacturers:
   1. As specified on drawings.
   2. Substitutions: See Section 01 25 00 - Substitution Procedures.

2.05 BALLASTS

A. Manufacturers:
   1. Osram Sylvania: www.sylvania.com.
   2. Philips Lighting Electronics/Advance: www.advance.philips.com.
   3. Substitutions: See Section 01 25 00 - Substitution Procedures.
   4. Manufacturer Limitations: Where possible, for each type of luminaire provide ballasts produced by a single manufacturer.

B. All Ballasts:
   1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
   2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.

C. Fluorescent Ballasts:
   1. All Fluorescent Ballasts: Unless otherwise indicated, provide high frequency electronic ballasts complying with ANSI C82.11 and listed and labeled as complying with UL 935.
      a. Input Voltage: Suitable for operation at voltage of connected source, with variation tolerance of plus or minus 10 percent.
      b. Total Harmonic Distortion: Not greater than 20 percent.
      c. Power Factor: Not less than 0.97.
      d. Ballast Factor: Normal ballast factor 0.90.
      e. Thermal Protection: Listed and labeled as UL Class P, with automatic reset for integral thermal protectors.
      f. Sound Rating: Class A, suitable for average ambient noise level of 20 to 24 decibels.
      g. Lamp Compatibility: Specifically designed for use with the specified lamp, with no visible flicker.
      h. Lamp Operating Frequency: Greater than 20 kHz, except as specified below.
         1) Do not operate lamp(s) within the frequencies from 30 kHz through 40 kHz in order to avoid interference with infrared devices.
      i. Lamp Current Crest Factor: Not greater than 1.7.
      j. Lamp Wiring Method:
         1) Programmed Start Ballasts: Provide parallel or series/parallel wired where available; otherwise series wired is acceptable.
      k. Provide automatic restart capability to restart replaced lamp(s) without requiring resetting of power.
      l. Surge Tolerance: Capable of withstanding characteristic surges according to IEEE C62.41.2, location category A.
      m. Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC requirements of CFR, Title 47, Part 18, for Class A, non-consumer application.
      n. Ballast Marking: Include wiring diagrams with lamp connections.
   2. Non-Dimming Fluorescent Ballasts:
      a. Lamp Starting Method:
         1) T8 Lamp Ballasts: Programmed start unless otherwise indicated.
   3. Dimming Ballasts:
      a. 0-10V DC control.
      b. Dimming to 5% without flicker.

2.06 LAMPS

A. T8 Lamp Manufacturers: (Max 3.5-mg of Hg/lamp)
   1. Philips Lighting Co of NA; Model ALTO: www.lighting.philips.com.
   2. Sylvania OCRON XPS Ecologic.
   3. Substitutions: See Section 01 25 00 - Substitution Procedures.
   4. Manufacturer Limitations: Where possible, provide lamps produced by a single manufacturer.

B. All Lamps:
   1. Unless explicitly excluded, provide new, compatible, operable lamps in each luminaire.
   2. Verify compatibility of specified lamps with luminaires to be installed. Where lamps are not specified, provide lamps per luminaire manufacturer's recommendations.
   3. Minimum Efficiency: Provide lamps complying with all current applicable federal and state lamp efficiency standards.
   4. Color Temperature Consistency: Unless otherwise indicated, for each type of lamp furnish products which are consistent in perceived color temperature. Replace lamps that are determined by the Architect to be inconsistent in perceived color temperature. Minimum CRI for fluorescent lamps shall be 0.85.

C. Linear Fluorescent Lamps: Wattage and bulb type as indicated, with base type as required for luminaire.

D. Compact Fluorescent (CFL) Manufacturer: (Max 1.5-mg of Hg/lamp)
   1. Philips Lighting Co of NA: Model ALTO CFL

E. Lamp Types: As specified for each fixture.

F. High Intensity Discharge (HID) Lamps:
   1. Product: Submit product data
   2. Substitutions: See Section 01 25 00 - Substitution Procedures.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.

C. Verify that suitable support frames are installed where required.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 26 05 37 as required for installation of luminaires provided under this section.

B. Install products according to manufacturer's instructions.

C. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 1 (general workmanship), NECA 500 (commercial lighting), and NECA 502 (industrial lighting).

D. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

E. Support surface mounted light fixture from structure, independent of ceiling system, using 3/8" all thread rods.

F. Light fixtures recessed in lay in ceilings shall be installed so that the long dimension of the fixture is supported on the main support member. Provide at least (2) galvanized steel safety wires or chains run to structure.

G. Install fixtures securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting).

H. Install wall mounted luminaires, emergency lighting units, and exit signs at height as indicated on Drawings.

I. Install accessories furnished with each luminaire.

J. Bond products and metal accessories to branch circuit equipment grounding conductor.

K. Install specified lamps in each emergency lighting unit and luminaire.

L. Fluorescent Luminaires Controlled by Dual-Level Switching: Connect such that each switch controls the same corresponding lamps in each luminaire.

M. Emergency Lighting Units and Exit Signs:
   1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.

N. Install lamps in each luminaire.

3.04 FIELD QUALITY CONTROL

A. Inspect each product for damage and defects.

B. Operate each luminaire after installation and connection to verify proper operation.

C. Test emergency lighting units to verify proper operation upon loss of normal power supply.

D. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect and Owner's Authorized Representative.

3.05 ADJUSTING

A. Aim and position adjustable emergency lighting unit lamps to achieve optimum illumination of egress path as required or as directed by Architect and Owner's Authorized Representative or authority having jurisdiction.

B. Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by Architect and Owner's Authorized Representative or authority having jurisdiction.

3.06 CLEANING

A. Clean surfaces according to NECA 500 (commercial lighting), NECA 502 (industrial lighting), and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.07 CLOSEOUT ACTIVITIES

A. Demonstration: Demonstrate proper operation of luminaires to Owner's personnel, and correct deficiencies or make adjustments as directed.

B. Just prior to Substantial Completion, replace all lamps that have failed.

END OF SECTION

SECTION 26 56 00
EXTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Exterior luminaires.

B. Ballasts.

C. Lamps.

D. Luminaire accessories.

1.02 REFERENCE STANDARDS

A. ANSI C78.379 - American National Standard for Electric Lamps -- Reflector Lamps -- Classification of Beam Patterns; 2006.

B. ANSI C82.1 - American National Standard for Lamp Ballast - Line Frequency Fluorescent Lamp Ballast; 2004.

C. ANSI C82.11 - American National Standard for Lamp Ballasts - High Frequency Fluorescent Lamp Ballasts - Supplements; 2011.

D. ANSI C136.10 - American National Standard for Roadway and Area Lighting Equipment - Locking-Type Photocontrol Devices and Mating Receptacles - Physical and Electrical Interchangeability and Testing; 2010.

E. IEEE C62.41.2 - Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits; 2002 (Cor 1, 2012).

F. NECA 1 - Standard for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; 2010.

G. NECA/IESNA 501 - Recommended Practice for Installing Exterior Lighting Systems; 2006.

H. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. UL 935 - Fluorescent-Lamp Ballasts; Current Edition, Including All Revisions.

1.03 SUBMITTALS

A. See Section 01 3300 for submittal procedures.

B. Shop Drawings: Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, weight, effective projected area (EPA), and installed accessories; include model number nomenclature clearly marked with all proposed features.

D. Test Reports: Indicate measured illumination levels.

E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

F. Operation and Maintenance Data: Instructions for each product including information on replacement parts.

1.04 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented commercial experience.

C. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 LUMINAIRES

A. Provide products that comply with requirements of NFPA 70.

B. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

C. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

D. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.

E. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

F. Provide luminaires listed and labeled as suitable for wet locations unless otherwise indicated.

G. Provide products suitable for coastal, exterior environment (i.e. salt water).

H. Exposed Hardware: Stainless steel.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.

C. Verify that suitable support frames are installed where required.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 26 05 37 as required for installation of luminaires provided under this section.

B. Install products according to manufacturer's instructions.

C. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 1 (general workmanship) and NECA/IESNA 501 (exterior lighting).

D. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.

E. Install accessories furnished with each luminaire.

F. Bond products and metal accessories to branch circuit equipment grounding conductor.

G. Install lamps in each luminaire.

H. Bond luminaires, metal accessories, and metal poles to branch circuit equipment grounding conductor.

3.03 FIELD QUALITY CONTROL

A. Inspect each product for damage and defects.

B. Perform field inspection, testing, and adjusting in accordance with Section 01 45 00.

C. Operate each luminaire after installation and connection to verify proper operation.

D. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect and Owner's Authorized Representative.

3.04 ADJUSTING

A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect and Owner's Authorized Representative. Secure locking fittings in place.

B. Aim and adjust luminaires to provide illumination levels and distribution indicated on Drawings.

3.05 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

END OF SECTION

SECTION 28 31 00
FIRE DETECTION AND ALARM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire alarm system design and installation, including all components, wiring, and conduit.

B. Transmitters for communication with supervising station.

C. Circuits from protected premises to supervising station, including conduit.

D. Replacement and removal of existing fire alarm system components, wiring, and conduit indicated.

E. Maintenance of fire alarm system under contract for specified warranty period.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.

B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

C. IEEE C62.41.2 - Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits; 2002 (Cor 1, 2012).

D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. NFPA 72 - National Fire Alarm and Signaling Code; 2013.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Evidence of designer qualifications.

C. Design Documents: Submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, riser diagrams, and description of operation:
   1. Copy (if any) of list of data required by authority having jurisdiction.
   2. NFPA 72 "Record of Completion", filled out to the extent known at the time.
   3. Clear and concise description of operation, with input/output matrix similar to that shown in NFPA 72 Appendix A-7-5-2.2(9), and complete listing of software required.
   4. System zone boundaries and interfaces to fire safety systems.
   5. Location of all components, circuits, and raceways; mark components with identifiers used in control unit programming.
   6. Circuit layouts; number, size, and type of raceways and conductors; conduit fill calculations; spare capacity calculations; notification appliance circuit voltage drop calculations.
   7. List of all devices on each signaling line circuit, with spare capacity indicated.
   8. Manufacturer's detailed data sheet for each component, including wiring diagrams, installation instructions, and circuit length limitations.
   9. Description of power supplies; if secondary power is by battery include calculations demonstrating adequate battery power.
   10. Certification by either the manufacturer of the control unit or by the manufacturer of each other component that the components are compatible with the control unit.
   11. Certification by the manufacturer of the control unit that the system design complies with the contract documents.
   12. Certification by Contractor that the system design complies with the contract documents.
   13. Do not show existing components to be removed.

D. Evidence of installer qualifications.

E. Evidence of maintenance contractor qualifications, if different from installer.

F. Inspection and Test Reports:
   1. Submit inspection and test plan prior to closeout demonstration.
   2. Submit documentation of satisfactory inspections and tests.
   3. Submit NFPA 72 "Inspection and Test Form," filled out.

G. Operating and Maintenance Data: See Section 01 78 00 for additional requirements; revise and resubmit until acceptable; have one set available during closeout demonstration:
   1. Complete set of specified design documents, as approved by authority having jurisdiction.
   2. Additional printed set of project record documents and closeout documents, bound or filed in same manuals.
   3. Contact information for firm that will be providing contract maintenance and trouble call-back service.
   4. List of recommended spare parts, tools, and instruments for testing.
   5. Replacement parts list with current prices, and source of supply.
   6. Detailed troubleshooting guide and large scale input/output matrix.
   7. Preventive maintenance, inspection, and testing schedule complying with NFPA 72; provide printed copy and computer format acceptable to Owner.
   8. Detailed but easy to read explanation of procedures to be taken by non-technical administrative personnel in the event of system trouble, when routine testing is being conducted, for fire drills, and when entering into contracts for remodeling.

H. Project Record Documents: See Section 01 78 00 for additional requirements; have one set available during closeout demonstration:
   1. Complete set of floor plans showing actual installed locations of components, conduit, and zones.
   2. "As installed" wiring and schematic diagrams, with final terminal identifications.
   3. "As programmed" operating sequences, including control events by device, updated input/output chart, and voice messages by event.

I. Closeout Documents:
   1. Certification by manufacturer that the system has been installed in compliance with his installation requirements, is complete, and is in satisfactory operating condition.
   2. NFPA 72 "Record of Completion", filled out completely and signed by installer and authorized representative of authority having jurisdiction.

1.05 QUALITY ASSURANCE

A. Designer Qualifications: NICET Level III or IV (3 or 4) certified fire alarm technician or registered fire protection engineer, employed by fire alarm control panel manufacturer, Contractor, or installer, with experience designing fire alarm systems in the jurisdictional area of the authorities having jurisdiction.

B. Installer Qualifications: Firm with minimum 3 years documented experience installing fire alarm systems of the specified type and providing contract maintenance service as a regular part of their business.
   1. Authorized representative of control unit manufacturer; submit manufacturer's certification that installer is authorized; include name and title of manufacturer's representative making certification.
   2. Installer Personnel: At least 2 years of experience installing fire alarm systems.
   3. Supervisor: NICET level III or IV (3 or 4) certified fire alarm technician; furnish name and address.

C. Maintenance Contractor Qualifications: Same entity as installer or different entity with specified qualifications.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fire Alarm Control Units - Basis of Design: SELECT/ENTER MANUFACTURER NAME AND ENTER MODEL NUMBER.

2.02 FIRE ALARM SYSTEM

A. Fire Alarm System: Provide a new automatic fire detection and alarm system:
   1. Provide all components necessary, regardless of whether shown in the contract documents or not.
   2. Protected Premises: Entire building shown on drawings.
   3. Comply with the following; where requirements conflict, order of precedence of requirements is as listed:
      a. ADA Standards.
      b. The requirements of the local authority having jurisdiction, which is _____.
      c. Applicable local codes.
      d. The contract documents (drawings and specifications).
      e. NFPA 72; where the word "should" is used consider that provision mandatory; where conflicts between requirements require deviation from NFPA 72, identify deviations clearly on design documents.
   4. Evacuation Alarm: Multiple smoke zones; allow for evacuation notification of any individual zone or combination of zones, in addition to general evacuation of entire premises.
   5. Voice Notification: Provide emergency voice/alarm communications with multichannel capability; digital.
   6. General Evacuation Zones: Each smoke zone is considered a general evacuation zone unless otherwise indicated, with alarm notification in all zones on the same floor, on the floor above, and the floor below.
   7. Program notification zones and voice messages as directed by Owner.
   8. Fire Command Center: Location indicated on drawings.
   9. Master Control Unit (Panel): New, located at fire command center.

B. Supervising Stations and Fire Department Connections:
   1. Public Fire Department Notification: By on-premises supervising station.
   2. On-Premises Supervising Station: Existing proprietary station operated by Owner, located at _____.
   3. Means of Transmission to On-Premises Supervising Station: Directly connected noncoded system.

C. Circuits:
   1. Initiating Device Circuits (IDC): Class B, Style A.
   2. Signaling Line Circuits (SLC) Within Single Building: Class B, Style 0.5.
   3. Notification Appliance Circuits (NAC): Class B, Style W.

D. Power Sources:
   1. Primary: Dedicated branch circuits of the facility power distribution system.
   2. Secondary: Storage batteries.
   3. Capacity: Sufficient to operate entire system for period specified by NFPA 72.
   4. Each Computer System: Provide uninterruptible power supply (UPS).

2.03 EXISTING COMPONENTS

A. On-Premises Supervising Station: Include as part of this work all modifications necessary to existing supervising station to accommodate new fire alarm work.

B. Clearly label components that are "Not In Service."

C. Remove unused existing components and materials from site and dispose of properly.

2.04 FIRE SAFETY SYSTEMS INTERFACES

A. Supervision: Provide supervisory signals in accordance with NFPA 72 for the following:

B. Alarm: Provide alarm initiation in accordance with NFPA 72 for the following:

2.05 COMPONENTS

A. General:
   1. Provide flush mounted units where installed in finish areas; in unfinished areas, surface mounted unit are acceptable.
   2. Provide legible, permanent labels for each control device, using identification used in operation and maintenance data.

B. Fire Alarm Control Units, Initiating Devices, and Notification Appliances: Analog, addressable type; listed, classified, and labeled as suitable for the purpose intended.

C. Master Control Unit: As specified for Basis of Design above, or equivalent.

D. Initiating Devices:

E. Notification Appliances:

F. Circuit Conductors: Copper or optical fiber; provide 200 feet extra; color code and label.

G. Surge Protection: In accordance with IEEE C62.41.2 category B combination waveform and NFPA 70; except for optical fiber conductors.

H. Locks and Keys: Deliver keys to Owner.

I. Instruction Charts: Printed instruction chart for operators, showing steps to be taken when a signal is received (normal, alarm, supervisory, and trouble); easily readable from normal operator's station.
   1. Frame: Stainless steel or aluminum with polycarbonate or glass cover.
   2. Provide one for each control unit where operations are to be performed.
   3. Obtain approval of Owner prior to mounting; mount in location acceptable to Owner.
   4. Provide extra copy with operation and maintenance data submittal.

END OF SECTION

SECTION 32 17 23.13
PAINTED PAVEMENT MARKINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Parking lot markings, including parking bays and handicapped symbols.

1.02 RELATED REQUIREMENTS

A. Section 32 12 16 - Asphalt Paving.

1.03 REFERENCE STANDARDS

A. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association; current edition, www.paintinfo.com.

B. FHWA MUTCD - Manual on Uniform Traffic Control Devices for Streets and Highways; U.S. Department of Transportation, Federal Highway Administration; http://mutcd.fhwa.dot.gov; current edition.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

C. Certificates: Submit for each batch of paint stating compliance with specified requirements.

1.05 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.

1.06 PROJECT 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 No. 97 Latex Traffic Marking Paint; color(s) as indicated.
   1. Parking Lots: Yellow.
   2. Handicapped Symbols: Blue.

B. Temporary Marking Tape: Preformed, reflective, pressure sensitive adhesive tape in color(s) required; Contractor is responsible for selection of material of sufficient durability as to perform satisfactorily during period for which its use is required.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

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

3.02 PREPARATION

A. Allow new pavement surfaces to cure for a period of not less than 14 days before application of marking materials.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Clean surfaces thoroughly prior to installation.
   1. Remove dust, dirt, and other granular surface deposits by sweeping, blowing with compressed air, rinsing with water, or a combination of these methods.
   2. Completely remove rubber deposits, existing paint markings, and other coatings adhering to the pavement, by scraping, wire brushing, sandblasting, mechanical abrasion, or approved chemicals.

D. Where oil or grease are present, scrub affected areas with several applications of trisodium phosphate solution or other approved detergent or degreaser, and rinse thoroughly after each application; after cleaning, seal oil-soaked areas with cut shellac to prevent bleeding through the new paint.

E. Establish survey control points to determine locations and dimensions of markings; provide templates to control paint application by type and color at necessary intervals.

F. Temporary Pavement Markings: When required or directed by Architect, apply temporary markings of the color(s), width(s) and length(s) as indicated or directed.
   1. After temporary marking has served its purpose, remove temporary marking by carefully controlled sandblasting, approved grinding equipment, or other approved method so that surface to which the marking was applied will not be damaged.
   2. At Contractor's option, temporary marking tape may used in lieu of temporary painted marking; remove unsatisfactory tape and replace with painted markings at no additional cost to Owner.

3.03 INSTALLATION

A. Begin pavement marking as soon as practicable after surface has been cleaned and dried.

B. Do not apply paint if temperature of surface to be painted or the atmosphere is less than 50 degrees F or more than 95 degrees F.

C. Apply in accordance with manufacturer's instructions using an experienced technician that is thoroughly familiar with equipment, materials, and marking layouts.

D. Comply with FHWA MUTCD manual (http://mutcd.fhwa.dot.gov) for details not shown.

E. Apply markings in locations determined by measurement from survey control points; preserve control points until after markings have been accepted.

F. Apply uniformly painted markings of color(s), lengths, and widths as indicated on the drawings true, sharp edges and ends.
   1. Apply paint in one coat only.
   2. Wet Film Thickness: 0.015 inch, minimum.
   3. Length Tolerance: Plus or minus 3 inches.
   4. Width Tolerance: Plus or minus 1/8 inch.

G. Parking Lots: Apply parking space lines, entrance and exit arrows, painted curbs, and other markings indicated on drawings.
   1. Mark the International Handicapped Symbol at indicated parking spaces.
   2. Hand application by pneumatic spray is acceptable.

H. Symbols: Use a suitable template that will provide a pavement marking with true, sharp edges and ends, of the design and size indicated.

3.04 DRYING, PROTECTION, AND REPLACEMENT

A. Protect newly painted markings so that paint is not picked up by tires, smeared, or tracked.

B. Provide barricades, warning signs, and flags as necessary to prevent traffic crossing newly painted markings.

C. Allow paint to dry at least the minimum time specified by the applicable paint standard and not less than that recommended by the manufacturer.

D. Remove and replace markings that are applied at less than minimum material rates; deviate from true alignment; exceed length and width tolerances; or show light spots, smears, or other deficiencies or irregularities.

E. Remove markings in manner to avoid damage to the surface to which the marking was applied, using carefully controlled sand blasting, approved grinding equipment, or other approved method.

F. Replace removed markings at no additional cost to Owner.

END OF SECTION

SCHEDULES

MARION COUNTY HEALTH CLINIC - DOOR SCHEDULE

Door							Frame			Details			Handle	Hardware	Comments
Door Number	New or Exist.	Size	Door Type	Door Material	Finish	Fire Rating	Type	Material	Finish	Head	Jamb	Sill	Type	Group	
Level 1															
1341A		(E)											LH		Faulty
1353A		(E)											LH		To be demolished
1101A	(N)	3'-0"x7'-0"	A	HM	PT		A	HM	PT						
1101B	(N)	3'-0"x7'-0"	A	HM	PT		A	HM	PT						
1101C	(N)	3'-0"x7'-0"	E	WD	LAM		A	STL							
1104A	(N)	3'-0"x7'-0"	C	AL	NAT		A	AL	NAT						
1106A	(N)	3'-0"x7'-0"	A	WD	PT		A	HM	PT						
1106B	(N)	3'-0"x7'-0"	C	AL	NAT		A	AL	NAT						
1114		(E)											RH		Replace door hardware w/ LH
1117		(E)											RH		Replace door hardware w/ LH
1118		(E)											RH		Replace door hardware w/ LH
1119		(E)											LH		
1124		(E)											LH		
1126A	(N)	3'-0"x7'-0"	C	AL	PT		A	AL	NAT						
1126B	(N)	3'-0"x7'-0"	A	HM	PT		A	HM	PT						
1136A	(N)	3'-0"x7'-0"	A	WD	PT		A	HM	PT						
1138		(E)											RH		Replace door hardware w/ LH
1139		(E)											RH		Replace door hardware w/ LH
1140		(E)											RH		Replace door hardware w/ LH
1145		(E)											RH		Less than 32" wide. Replace dr. hardware w/ LH
1146		(E)											RH		Less than 32" wide. Replace dr. hardware w/ LH
1150	(N)	3'-0"x7'-0"	A	WD	ST		A	HM	PT						
1150A	(D)												RH		To be demolished
1151	(N)	3'-0"x7'-0"	A	WD	ST		A	HM	PT						
1152	(N)	3'-0"x7'-0"	A	WD	ST		A	HM	PT						
1152A	(D)	(D)													To be demolished
1152B	(D)	(D)													To be demolished
1154		(E)											RH		Replace door hardware w/ LH
1155		(E)											RH		Replace door hardware w/ LH
1160		(E)											RH		To be demolished
1160A	(N)	3'-0"x7'-0"	A	HM	PT		A	HM	PT						
1164	(D)	(D)											RH		To be demolished
1164	(N)	(D)													
1166A	(N)	3'-0"x7'-0"	A	HM	PT		A	HM	PT						
1167	(D)												PH		To be demolished
1167A	(N)	3'-0"x7'-0"	A	HM	PT		A	HM	PT						
1167B	(N)	3'-0"x7'-0"	C	AL	PT		A	HM	PT						
1170	(D)														To be demolished
1170	(N)	3'-0"x7'-0"	B										RH		Replace door hardware w/ LH
1171		(E)											LH		
1174		(E)											RH		Replace door hardware w/ LH
1175		(E)											RH		Replace door hardware w/ LH
1176		(E)											RH		Replace door hardware w/ LH
1177		(E)											RH		Replace door hardware w/ LH
1181		(E)											RH		Replace door hardware w/ LH
1182		(E)											RH		Replace door hardware w/ LH
1183		(E)											RH		Replace door hardware w/ LH
1184		(E)											RH		Replace door hardware w/ LH
1185		(E)											RH		Replace door hardware w/ LH
1187A	(D)												PH		Grade to right. Replaced with building evelope
1187A	(N)	3'-0"x7'-0"	C	AL	PT		A	AL	PT						Part of new curtain wall system
1190													RH		Replace door hardware w/ LH
1215													RH		Replace door hardware w/ LH
1217A													RH		Replace door hardware w/ LH
1217B													RH		Replace door hardware w/ LH
1231					NAT		A	HM	PT				PH		Automatic door opener. To be demolished.
1231A	(N)	6'-0" x 7'-0"	C	AL	PT		C	AL	NAT						

Door Number	New or Exist.	Size	Door Type	Door Material	Finish	Fire Rating	Type	Material	Finish	Head	Jamb	Sill	Type	Group	
1237		(E)											RH		Replace door hardware w/ LH
1242		(E)											RH		Replace door hardware w/ LH
1243		(E)											RH		Replace door hardware w/ LH
1244		(E)											RH		Replace door hardware w/ LH
1245		(E)											RH		Replace door hardware w/ LH
1246		(E)											LH		Actual number HB-1258
1247		(E)											RH		Replace door hardware w/ LH
1252		(E)											RH		Replace door hardware w/ LH
1254		(E)											P		Men's RR
1255A	(N)	3'-0"x7'-0"	A	HM	PT		A	HM	PT						
1257		(E)											RH		Replace door hardware w/ LH
1263		(E)											RH		Replace door hardware w/ LH
1264A	(N)	3'-0"x7'-0"	A	HM	PT		A	HM	PT						
1265A	(N)	3'-0"x7'-0"	A	HM	PT		A	HM	PT						
1267A		(E)											RH		Replace door hardware w/ LH
1267B		(E)											RH		Replace door hardware w/ LH
1268A	(N)	6'-0" x 7'-0"	B	WD	PT		D	HM	PT						
1284		(E)											RH		Replace door hardware w/ LH
1341AA	(N)	6'-0" x 7'-0"	A	WD	PT		C	HM	PT						
1341BA	(N)	3'-0"x7'-0"	A												
1341BB	(N)	3'-0"x7'-0"	C												
1341BC	(N)	6'-0" x 7'-0"	A				C	HM	PT						
1350A		(E)											LH		Closure. Faulty on push side.
1350B		(E)											RH		Non-lever handles
1352A	(N)	3'-0"x7'-0"	A	HM	PT		A	HM	PT						
1353A	(N)	3'-0"x7'-0"	A	WD	ST		A	HM	PT						
1357A	(N)	3'-0"x7'-0"	A	WD	ST		A	HM	PT						
1357B	(N)	6'-0" x 7'-0"	A	WD	ST		A	HM	PT						
1358A	(N)	3'-0"x7'-0"	A	WD	ST		A	HM	PT						
1360A	(N)	3'-0"x7'-0"	A	HM	PT		A	HM	PT						
1360B	(N)	3'-0"x7'-0"	A	HM	PT		A	HM	PT						
1361		(E)											RH		Replace door hardware w/ LH
1364A	(N)	3'-0"x7'-0"	A	WD	ST		A	HM	PT						
1367A	(N)	3'-0"x7'-0"	A	WD	ST		A	HM	PT						
1368A	(N)	3'-0"x7'-0"	A	WD	ST		A	HM	PT						
1370		(E)											RH		Non-public access
1377A	(N)	3'-0"x7'-0"	A	WD	ST		A	HM	PT						
1378A	(N)	3'-0"x7'-0"	A	WD	ST		A	HM	PT						
1382A	(N)	3'-0"x7'-0"	A	WD	ST		A	HM	PT						
1384A	(N)	3'-0"x7'-0"	A	WD	ST		A	HM	PT						
1385A	(N)	3'-0"x7'-0"	A	WD	ST		A	HM	PT						
1386A	(N)	3'-0"x7'-0"	A	WD	ST		A	HM	PT						
1388A	(N)	3'-0"x7'-0"	A	WD	ST		A	HM	PT						
1392A	(N)	3'-0"x7'-0"	A	WD	ST		A	HM	PT						
1393A	(N)	3'-0"x7'-0"	A	WD	ST		A	HM	PT						
1394		(E)											RH		Replace door hardware w/ LH
1395A	(N)	3'-0"x7'-0"	A	WD	ST		A	HM	PT						
1396A	(N)	3'-0"x7'-0"	A	WD	ST		A	HM	PT						
1397A	(N)	3'-0"x7'-0"	A	WD	ST		A	HM	PT						
1398A	(N)	3'-0"x7'-0"	A	WD	ST		A	HM	PT						
1394A													LH		Concrete pad outside leads to unpaved area.

Level 2

2252	(D)														Diaper Changing Room
2252	(N)	3'-0"x7'-0"		WD	ST		A	HM	PT						
2350C		(E)													
2102		(E)											RH		No closure strike-side, push side fine
2151		(E)													
2181		(E)											RH		Replace door hardware w/ LH
2190		(E)											LH		
2191		(E)											RH		Replace door hardware w/ LH
2208		(E)											RH		Replace door hardware w/ LH

Door Number	New or Exist.	Size	Door Type	Door Material	Finish	Fire Rating	Type	Material	Finish	Head	Jamb	Sill	Type	Group	
2216A		(E)											RH		Replace door hardware w/ LH
2218		(E)											RH		Replace door hardware w/ LH
2228		(E)											RH		Replace door hardware w/ LH
2231		(E)											LH		Faulty
2236		(E)											RH		Storage
2238		(E)											LH		45" switch height to center
2240		(E)											LH		
2242		(E)											RH		Replace door hardware w/ LH
2244		(E)											LH		Code lock, secure
2247		(E)											LH		
2248		(E)											RH		Replace door hardware w/ LH
2250		(E)											RH		
2253		(E)											RH		
2254		(E)											P		
2255		(E)											LH		Storage
2258		(E)											RH		45" swch ht. to center. Replace dr. hardware w/ LH
2264		(E)													
2274		(E)											LH		
2276		(E)											LH		
2278		(E)											LH		
2279		(E)											LH		
2281		(E)											RH		Non compliant. Door swing too far into space
2282		(E)											LH		
2283		(E)											RH		Replace door hardware w/ LH
2285		(E)											RH		No door in opening.
2286		(E)											RH		Replace door hardware w/ LH
2287		(E)											RH		Replace door hardware w/ LH
2290		(E)											RH		Replace door hardware w/ LH
2291		(E)											RH		Replace door hardware w/ LH
2292		(E)											RH		Replace door hardware w/ LH
2296		(E)											RH		Replace door hardware w/ LH
2297		(E)											RH		Replace door hardware w/ LH
2350A		(E)											LH		
2340		(E)											LH		
2360		(E)											LH		
2367		(E)											RH		Replace door hardware w/ LH
2369		(E)											RH		Replace door hardware w/ LH
2370		(E)											RH		Replace door hardware w/ LH
2371		(E)											RH		Replace door hardware w/ LH
2374		(E)											RH		Replace door hardware w/ LH
2379		(E)											RH		Replace door hardware w/ LH
2383		(E)											RH		Replace door hardware w/ LH
2385		(E)											LH		
2386		(E)											RH		Replace door hardware w/ LH
2387		(E)											RH		Replace door hardware w/ LH
2389		(E)											RH		Replace door hardware w/ LH
2390		(E)											RH		Replace door hardware w/ LH
2391		(E)											RH		Replace door hardware w/ LH
2394		(E)											LH		4'-7 x 7'-8 landing
2396		(E)											RH		Replace door hardware w/ LH
2397		(E)											RH		Replace door hardware w/ LH
2398		(E)											RH		Replace door hardware w/ LH
2399		(E)											RH		Replace door hardware w/ LH

Level 3

3190		(E)											RH		Replace door hardware w/ LH
3208		(E)											RH		Replace door hardware w/ LH
3209		(E)											RH		Replace door hardware w/ LH
3215		(E)											RH		Replace door hardware w/ LH
3216		(E)											RH		Replace door hardware w/ LH
3217		(E)											RH		Replace door hardware w/ LH
3218		(E)											RH		Replace door hardware w/ LH

Door Number	New or Exist.	Size	Door Type	Door Material	Finish	Fire Rating	Type	Material	Finish	Head	Jamb	Sill	Type	Group	
3222		(E)											RH		Replace door hardware w/ LH
3223		(E)											RH		Replace door hardware w/ LH
3224		(E)											RH		Replace door hardware w/ LH
3228		(E)											RH		Replace door hardware w/ LH
3238		(E)											RH		Replace door hardware w/ LH
3243A	(N)	3'-0"x7'-0"	A	HM	PT		A	HM	PT						
3244		(E)											RH		Replace door hardware w/ LH
3245		(E)											RH		Replace door hardware w/ LH
3247		(E)											RH		Replace door hardware w/ LH
3248		(E)											RH		Replace door hardware w/ LH
3253		(E)											RH		Replace door hardware w/ LH
3254		(E)											P		Electrical panel behind door
3255		(E)											RH		Replace door hardware w/ LH
3257		(E)											RH		Replace door hardware w/ LH
3258		(E)											LH		
3263		(E)											RH		Replace door hardware w/ LH
3265		(E)											RH		Replace door hardware w/ LH
3266		(E)											RH		Replace door hardware w/ LH
3268		(E)											RH		Replace door hardware w/ LH
3270		(E)											RH		Replace door hardware w/ LH
3274		(E)											RH		Replace door hardware w/ LH
3276		(E)											RH		Replace door hardware w/ LH
3278		(E)											RH		Replace door hardware w/ LH
3280		(E)											RH		Replace door hardware w/ LH
3281		(E)											RH		Replace door hardware w/ LH
3282		(E)											RH		Replace door hardware w/ LH
3284		(E)											RH		Replace door hardware w/ LH
3285		(E)											RH		Replace door hardware w/ LH
3287		(E)											RH		Replace door hardware w/ LH
3288A		(E)											RH		Replace door hardware w/ LH
3288B		(E)											RH		Replace door hardware w/ LH
3290		(E)											RH		Replace door hardware w/ LH
3291		(E)											RH		Replace door hardware w/ LH
3292		(E)											RH		Replace door hardware w/ LH
3293		(E)											RH		Replace door hardware w/ LH
3294		(E)											RH		Replace door hardware w/ LH
3296		(E)											RH		Column 4' behind door opening, faulty
3297		(E)											RH		Replace door hardware w/ LH
3298		(E)											LH		Replace door hardware w/ LH
3350A	(N)	3'-0"x7'-0"	A	HM	PT		A	HM	PT						
3350B	(N)	3'-0"x7'-0"	A	HM	PT		A	HM	PT						
3350C	(N)	3'-0"x7'-0"	A	HM	PT		A	HM	PT						
3360A	(N)	3'-0"x7'-0"	A	HM	PT		A	HM	PT						
3361		(E)											RH		Replace door hardware w/ LH
3364		(E)											RH		Replace door hardware w/ LH
3374		(E)											RH		Replace door hardware w/ LH
3384		(E)											RH		48" switch height to center
3390		(E)											RH		Replace door hardware w/ LH
3391		(E)											LH		
3392		(E)											RH		Replace door hardware w/ LH
3393		(E)											RH		Replace door hardware w/ LH
3394		(E)											LH		6'-8" x 5'-10" landing
3396A	(N)	3'-0"x7'-0"	A		PT		A	HM	PT						

Door Number	New or Exist.	Size	Door Type	Door Material	Finish	Fire Rating	Type	Material	Finish	Head	Jamb	Sill	Type	Group	

ABBREVIATIONS

PT	PAINT	(E)	EXISTING - TO REMAIN
ST	STAIN	(N)	NEW
NAT	NATURAL ALUMINUM	(D)	EXISTING - TO BE DEMOLISHED
AL	ALUMINUM		
HM	HOLLOW METAL		
WD	WOOD		
STL	STEEL		
LAM	LAMINATE		

GENERAL NOTES:

A. AT LOCATIONS WHERE NEW HOLLOW METAL FRAMES ARE TO BE INSTALLED, FRAMES SHOULD BE FULLY GROUTED

B. AT LOCATIONS WHERE NEW FRAMES ARE INSTALLED IN NEW CMU WALLS, A CONCRETE LINTEL IS TO BE INSTALLED PER DETAILS DB16

C. AT LOCATIONS WHERE HOLLOW METAL FRAMES ARE INSTALLED IN NEW CMU WALLS, GROUT CMU CELLS SOLID ON EITHER SIDE OF OPENING PER DETAIL DB 17

ROOM FINISH SCHEDULE

Rm. #	ROOM NAME	FLOOR		BASE	WALL								CEILING		REMARKS
					NORTH / N.W.		EAST / N.E.		SOUTH / S.E.		WEST / S.W.				
		MAT.	FIN.	FIN.	MAT.	FIN.	MAT.	FIN.	MAT.	FIN.	MAT	FIN.	MAT	FIN.	
LEVEL 1															
1101	WAITING	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	LVT AS ALTERNATE #3
1104	CORR	CONC	CONC	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
1106	CONF.	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
1114	TB	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
1117	OFFICE	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
1118	OFFICE	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
1119	OFFICE	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
1121	RECEPTION	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
1124	INTERVIEW (3)	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
1126	LOBBY	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	LVT AS ALTERNATE #3
1127	CORR	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
1130	HALLWAY	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
1136	MULTI-PURP.	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
1138	OFFICE	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
1139	OFFICE	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
1140	STAFF	CONC	SV	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
1143	HALL	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
1144	SCALE	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	OTS	NA	
1145	TOILET	CONC	CT	CT	GWB	PS/CT	GWB	PS/CT	GWB	PS/CT	GWB	PS/CT	GWB	PS	
1146	TOILET	CONC	CT	CT	GWB	PS/CT	GWB	PS/CT	GWB	PS/CT	GWB	PS/CT	GWB	PS	
1150	BLOOD DRAW	CONC	SV	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
1151	EXAM02	CONC	SV	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
1152	EXAM 03	CONC	SV	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
1154	ADA UNISEX	CONC	CT	CT	GWB	PS/CT	GWB	PS/CT	GWB	PS/CT	GWB	PS/CT	GWB	PS	
1155	ADA UNISEX	CONC	CT	CT	GWB	PS/CT	GWB	PS/CT	GWB	PS/CT	GWB	PS/CT	GWB	PS	
1160	INTERVIEW (2)	CONC	SV	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
1164	CORR	CONC	SV	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
1166	INTERV.	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
1167	STAFF/BREAK	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
1170	CORR	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
1171	CORR	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
1174	TOILET	CONC	CT	CT	GWB	PS/CT	GWB	PS/CT	GWB	PS/CT	GWB	PS/CT	GWB	PS	
1175	DIRTY LAB	CONC	SV	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
1176	OFFICE	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
1177	QUIET / BF	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
1181	CLEAN LAB	CONC	SV	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
1182	INTERV. (1)	CONC	SV	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
1183	PHN01	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
1184	PHN02	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
1185	MEDS	CONC	SV	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
1187	CORRIDOR	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
1190	WEST STAIR	CONC	CONC	RBR	CONC	PS	CONC	PS	CONC	PS	CONC	PS	NA	NA	
1215	STAFF	CONC	SV	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
1217	STAFF	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
1225	HALL	CONC	VCT	RBR	GWB	PS	GWB	PS	N/A	PS	N/A	PS	ACT	ACT	

Rm. #	ROOM NAME	FLOOR		BASE	WALL								CEILING		REMARKS
					NORTH / N.W.		EAST / N.E.		SOUTH / S.E.		WEST / S.W.				
		MAT.	FIN.	FIN.	MAT.	FIN.	MAT.	FIN.	MAT.	FIN.	MAT	FIN.	MAT	FIN.	
1231	LOBBY	CONC	LVT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	OTS	NA	
1235	STAFF	CONC	CPT	RBR	GWB	PS	GWB	PS	N/A	PS	N/A	PS	ACT	ACT	
1237	OFFICE 2	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	PS	CTW	PS	ACT	ACT	
1240	STAIR	CONC	LVT	RBR	CONC	PS	CONC	PS	CONC	PS	GWB	PS	ACT	ACT	
1242	OFFICE7	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
1243	OFFICE6	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
1244	OFFICE5	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
1245	OFFICE4	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
1246	CORR	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
1247	OFFICE 1	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
1252	WOMEN	CONC	CT	CT	GWB	PS/CT	GWB	PS/CT	GWB	PS/CT	GWB	PS/CT	GWB	PS	
1254	MEN	CONC	CT	CT	GWB	PS/CT	GWB	PS/CT	GWB	PS/CT	GWB	PS/CT	GWB	PS	
1255	EQPM	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	OTS	NA	
1257	OFFICE 3	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
1263	JAN	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	OTS	NA	
1264	ADA TOILET	CONC	CT	CT	GWB	PS/CT	GWB	PS/CT	GWB	PS/CT	GWB	PS/CT	GWB	PS	
1265	STORAGE	CONC	CONC	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
1267	STAFF	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	CTW	PS	ACT	ACT	
1268	CORR	CONC	LVT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
1284	TELECOM	CONC	CONC	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	GWB	PS	
1341A	CONF. (1A)	CONC	VCT	RBR	CONC	PS	GWB	PS	GWB	PS	GWB	PS	ACT/OTS	ACT/NA	
1341B	CONF. (1B)	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT/OTS	ACT/NA	
1342	STORAGE	CONC	VCT	RBR	CONC	PS	CONC	PS	GWB	PS	CONC	PS	GWB	PS	
1343	STORAGE	CONC	VCT	RBR	CONC	PS	CONC	PS	GWB	PS	CONC	PS	GWB	PS	
1350	LOBBY	CONC	LVT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	OTS	NA	
1352	CLOSET	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	OTS	NA	
1353	OFFICE	CONC	VCT	RBR	GWB	PS	GWB	PS	CONC	PS	GWB	PS	ACT	ACT	
1357	KITCHEN TRAINING	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
1358	STAFF	CONC	VCT	RBR	GWB	PS	CONC/GWB(	PS	GWB	PS	GWB	PS	ACT	ACT	
1360	WAITING	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	CONC/GWB[	PS	ACT	ACT	LVT AS ALTERNATE #3
1363	CORR.	CONC	VCT	RBR	CONC	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
1364	RECEPTION	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
1367	OFFICE	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
1368	OFFICE	CONC	VCT	RBR	GWB	PS	CONC	PS	GWB	PS	GWB	PS	ACT	ACT	
1370	MECH	CONC	CONC	RBR	CONC	PS	CONC	PS	CONC	PS	CONC	PS	OTS	NA	
1377	TESTING	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
1378	CONSULT (10)	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
1382	CONSULT (1)	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	CONC	PS	ACT	ACT	
1383	CORR.	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
1384	CONSULT (3)	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
1385	CONSULT (5)	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
1386	CONSULT (7)	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
1387	CORR.	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
1388	CONSULT (9)	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
1392	CONSULT (2)	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	CONC	PS	ACT	ACT	

Rm. #	ROOM NAME	FLOOR		BASE	WALL								CEILING		REMARKS
					NORTH / N.W.		EAST / N.E.		SOUTH / S.E.		WEST / S.W.				
		MAT.	FIN.	FIN.	MAT.	FIN.	MAT.	FIN.	MAT.	FIN.	MAT	FIN.	MAT	FIN.	
1393	MGT./STOR.	CONC	VCT	RBR	GWB	PS	GWB	PS	CONC	PS	GWB	PS	ACT	ACT	
1394	STAIR	CONC	CONC	RBR	CONC	PS	CONC	PS	CONC	PS	CONC	PS	NA	NA	
1395	CONSULT (4)	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
1396	CONSULT (6)	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
1397	CONSULT (8)	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
1398	MEETING	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
M100	Room	CONC		RBR		PS		PS		PS		PS	ACT	ACT	
M101	Room	CONC		RBR		PS		PS		PS		PS	ACT	ACT	
M102	Room	CONC		RBR		PS		PS		PS		PS	ACT	ACT	
M103	COOLING TOWER	CONC		RBR		PS		PS		PS		PS	ACT	ACT	
Level 2															
2100	SUITE	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
2102	OFFICE	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
2151	OFFICE	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
2157	CORR	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
2181	OFFICE	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
2190	WEST STAIR	CONC	CONC.	RBR	CONC	PS	CONC	PS	CONC	PS	CONC	PS	NA	NA	
2191	CONF	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
2208	OFFICE	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	CF	ACT	ACT	
2216	STAFF	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
2218	OFFICE	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	CF	ACT	ACT	
2228	OFFICE	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	CF	ACT	ACT	
2230	STAIR	CONC	LVT	RBR	GWB	CF	N/A	PS	GWB	PS	N/A	PS	OTS	NA	
2231	LOBBY	CONC	LVT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
2235	BREAK	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
2236	STOR	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	OTS	NA	
2238	OFFICE	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	CF	ACT	ACT	
2240	STAIR	CONC	LVT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	OTS	NA	
2242	ROOM	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	OTS	NA	
2244	COMPUTER	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	OTS	NA	
2247	ROOM	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	OTS	NA	
2248	OFFICE	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	CF	ACT	ACT	
2250	LOBBY	CONC	LVT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	OTS	NA	
2252	ROOM	CONC	CT	CT	GWB	PS/CT	GWB	PS/CT	GWB	PS/CT	GWB	PS/CT	OTS	NA	
2253	WOMEN	CONC	CT	CT	GWB	PS/CT	GWB	PS/CT	GWB	PS/CT	GWB	PS/CT	GWB	PS	
2254	MEN	CONC	CT	CT	GWB	PS/CT	GWB	PS/CT	GWB	PS/CT	GWB	PS/CT	GWB	PS	
2255	EQPM	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	OTS	NA	
2258	STAFF	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	CF	ACT	ACT	
2264	STAFF	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
2268	STAFF	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	CF	ACT	ACT	
2270	SHAFT	CONC		RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	NA	
2274	WAITING	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	LVT AS ALTERNATE #3
2275	RECEPTION	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
2276	OFFICE	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	

Rm. #	ROOM NAME	FLOOR		BASE	WALL								CEILING		REMARKS
					NORTH / N.W.		EAST / N.E.		SOUTH / S.E.		WEST / S.W.				
		MAT.	FIN.	FIN.	MAT.	FIN.	MAT.	FIN.	MAT.	FIN.	MAT	FIN.	MAT	FIN.	
2278	OFFICE	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
2279	OFFICE	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	CF	ACT	ACT	
2281	TOILET	CONC	CT	CT	GWB	PS/CT	GWB	PS/CT	GWB	PS/CT	GWB	PS/CT	ACT	ACT	
2282	OFFICE	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
2283	OFFICE	CONC	CPT	RBR	CONC	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
2285	STOR	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
2286	OFFICE	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
2287	OFFICE	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	CF	ACT	ACT	
2290	OFFICE	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	CF	GWB	PS	ACT	ACT	
2291	OFFICE	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	CF	GWB	PS	ACT	ACT	
2292	OFFICE	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	CF	GWB	PS	ACT	ACT	
2294	STAFF	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	CF	GWB	PS	ACT	ACT	LVT AS ALTERNATE #3
2296	OFFICE	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	CF	GWB	PS	ACT	ACT	
2297	OFFICE	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	CF	GWB	CF	ACT	ACT	
2350	CONF	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	OTS	NA	
2360	WAITING	CONC	VCT	RBR	GWB	PS	GWB	PS	CONC/GWB	PS	GWB	PS	ACT	ACT	LVT AS ALTERNATE #3
2367	OFFICE	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
2369	OFFICE	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
2370	STAFF	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
2371	CONF	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
2374	WORK	CONC	SV	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
2376	STAFF	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
2379	OFFICE	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	CF	GWB	PS	ACT	ACT	
2383	OFFICE	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
2385	CORR	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
2386	OFFICE	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
2387	OFFICE	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
2389	OFFICE	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	CF	GWB	PS	ACT	ACT	
2390	OFFICE	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	CF	ACT	ACT	
2391	STAFF	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	CF	GWB	PS	ACT	ACT	
2394	SOUTH STAIR	CONC	CONC.	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	NA	NA	
2395	OFFICE	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
2397	OFFICE	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
2398	OFFICE	CONC	VCT	RBR	GWB	PS	GWB	CF	GWB	PS	GWB	PS	ACT	ACT	
2399	OFFICE	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
Level 3															
3190	WEST STAIR	CONC	CONC	RBR	CTW	CF	CON	PS	CON	PS	CON	PS	OTS	NA	
3208	OFFICE	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	CF	ACT	ACT	
3209	OFFICE	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	CF	ACT	ACT	
3215	OFFICE	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
3216	OFFICE	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
3217	OFFICE	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
3218	OFFICE	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	CF	ACT	ACT	

Rm. #	ROOM NAME	FLOOR		BASE	WALL								CEILING		REMARKS
					NORTH / N.W.		EAST / N.E.		SOUTH / S.E.		WEST / S.W.				
		MAT.	FIN.	FIN.	MAT.	FIN.	MAT.	FIN.	MAT.	FIN.	MAT	FIN.	MAT	FIN.	
3222	OFFICE	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
3223	OFFICE	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
3224	OFFICE	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
3228	OFFICE	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
3231	STAIR	CONC	LVT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	OTS	NA	
3238	OFFICE	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
3243	STAFF	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
3244	OFFICE	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
3245	OFFICE	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
3247	OFFICE	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
3248	OFFICE	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	CF	ACT	ACT	
3249	CORRIDOR	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
3250	LOBBY	CONC	LVT	RBR	GWB	PS	GWB	PS	CONC	PS	GWB	PS	OTS	NA	
3251	CORRIDOR	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	OTS	NA	
3253	WOMEN	CONC	CT	CT	GWB	PS/CT	GWB	PS/CT	GWB	PS/CT	GWB	PS/CT	GWB	PS	
3254	MEN	CONC	CT	CT	GWB	PS/CT	GWB	PS/CT	GWB	PS/CT	GWB	PS/CT	GWB	PS	
3257	OFFICE	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
3258	OFFICE	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	CF	ACT	ACT	
3263	CORR	CONC	LVT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
3264	CORR	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
3265	OFFICE	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
3266	OFFICE	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
3268	OFFICE	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	CF	ACT	ACT	
3270	MECH	CONC	CONC	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
3274	ROOM	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
3276	OFFICE	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
3277	CORR	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
3278	OFFICE	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	CF	ACT	ACT	
3280	OFFICE	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
3280H	CORR	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
3281	OFFICE	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
3282	OFFICE	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
3284	OFFICE	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
3284H	HALL	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
3285	OFFICE	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
3286	CORR	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
3287	STOR	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
3288	CONF	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	CF	ACT	ACT	
3290	OFFICE	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
3290H	CORR	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
3291	OFFICE	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	CF	GWB	PS	ACT	ACT	
3292	OFFICE	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	CF	GWB	PS	ACT	ACT	
3293	OFFICE	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	CF	GWB	PS	ACT	ACT	
3294	OFFICE	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	CF	GWB	PS	ACT	ACT	
3296	OFFICE	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	CF	GWB	PS	ACT	ACT	

Rm. #	ROOM NAME	FLOOR		BASE	WALL								CEILING		REMARKS
					NORTH / N.W.		EAST / N.E.		SOUTH / S.E.		WEST / S.W.				
		MAT.	FIN.	FIN.	MAT.	FIN.	MAT.	FIN.	MAT.	FIN.	MAT	FIN.	MAT	FIN.	
3297	OFFICE	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	CF	GWB	PS	ACT	ACT	
3298	OFFICE	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	CF	GWB	CF	ACT	ACT	
3350	WAITING	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	LVT AS ALTERNATE #3
3360	STAFF	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
3361	PHARMACY	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
3364	OFFICE	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	CF	GWB	PS	ACT	ACT	
3374	OFFICE	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	CF	GWB	PS	ACT	ACT	
3384	OFFICE	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	CF	GWB	PS	ACT	ACT	
3390	OFFICE	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	CF	GWB	PS	ACT	ACT	
3391	OFFICE	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	CF	GWB	PS	ACT	ACT	
3392	OFFICE	CONC	CPT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	ACT	ACT	
3393	ROOM	CONC	VCT	RBR	GWB	PS	GWB	PS	CONC	PS	GWB	PS	ACT	ACT	
3394	OFFICE	CONC	CPT	RBR	GWB	PS	GWB	PS	CTW	CF	GWB	PS	ACT	ACT	
3394	SOUTH STAIR	CONC	CONC	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	OTS	NA	
3396	ADA TOILET	CONC	VCT	RBR	GWB	PS	GWB	PS	GWB	PS	GWB	PS	GWB	PS	

APPENDIX

TECHNICAL MEMORANDUM

Branch ENGINEERING INC
Since 1977
civil · transportation
structural · geotechnical
SURVEYING

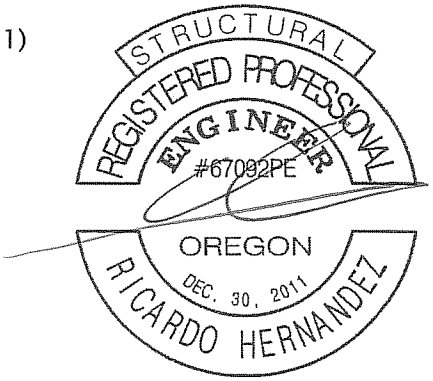
DATE: November 19, 2013

PROJECT: Marion County Health Services Building (13-241)
3180 Center Street, NE
Salem, Oregon

TO: Galen Ohmart, AIA

FROM: Rick Hernandez, PE, SE

RE: Component and Cladding Wind Pressures



Expires: JUNE 30, 2015

For the design of new storefront elements at the above-referenced project, the following component and cladding wind loads apply:

For vertical surfaces within 6 ft of any building corner	25.7 psf acting outward
For vertical surfaces 6 ft or more from any building corner	22.0 psf acting outward
-Or -	
For any vertical surface	20.2 psf acting inward

The above loads apply for storefronts with frames a minimum of 9 ft tall and spaced a minimum of 30" o.c. Whichever loading direction results in the most conservative design shall be used.

For the unique conditions at the lobby/stair entry, see the attached diagram.

A: 29.4 psf outward or 22.0 psf inward

B: 28.5 psf outward or 21.1 psf inward

C: 27.5 psf outward or 21.1 psf inward

D: 25.7 psf outward or 20.2 psf inward

E: 24.0 psf outward or 21.1 psf inward

F: 23.9 psf outward or 22.0 psf inward

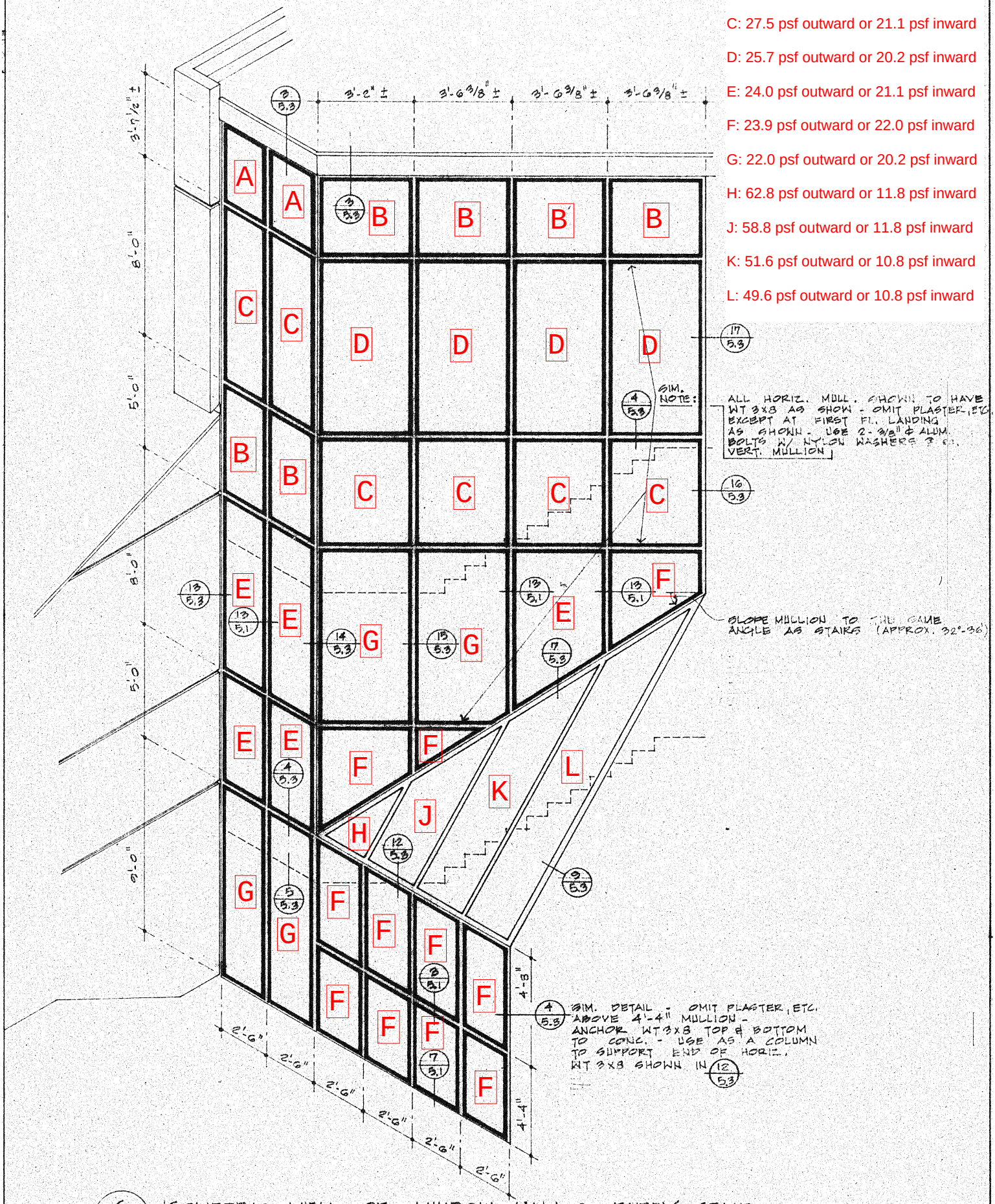
G: 22.0 psf outward or 20.2 psf inward

H: 62.8 psf outward or 11.8 psf inward

J: 58.8 psf outward or 11.8 psf inward

K: 51.6 psf outward or 10.8 psf inward

L: 49.6 psf outward or 10.8 psf inward



6 / 5.3 ISOMETRIC VIEW OF WINDOW WALL @ ENTRY STAIR

3" = 1'-0"

NOTE: SEE NORTHEAST ELEV. FOR GLASS TYPES & LOCATION