62 India Str
Portland, M
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Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

TABLE OF CONTENTS

FOR

62 INDIA STREET

PORTLAND, MAINE

DIVISION 1 - GENERAL REQUIREMENTS

011000 - Summary
013300 - Submittal Procedures
014000 - Quality Requirements
014200 – References
016000 - Product Requirements
016300 - Substitutions and Product Options
017700 - Closeout Procedures
017823 - Operation and Maintenance Data
017839 - Project Record Documents
017900 - Demonstration and Training

DIVISION 2 - EXISTING CONDITIONS

NOT USED

DIVISION 3 - CONCRETE

033000 - Cast-In-Place Concrete
035413 - Gypsum Cement Underlayment
039300 - Concrete Sealer

DIVISION 4 - MASONRY

042000 - Unit Masonry Assemblies

DIVISION 5 - METALS

051200 - Structural Steel Framing
055000 - Metal Fabrications

DIVISION 6 - WOOD, PLASTICS, AND COMPOSITES

061000 - Rough Carpentry
061920 - Metal-Plate-Connected Wood Trusses
062000 - Finish Carpentry

DIVISION 7 - THERMAL AND MOISTURE PROTECTION

071000 - Cementitious Waterproofing
072100 - Building Insulation
072110 - Spray-In-Place Rigid Urethane Foam Insulation

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

072300 - Under-Slab Vapor Retarders
072500 - Weather Barriers
074620 - Fiber Cement Siding
075323 - Ethylene-Propylene-Diene-Monomer (EPDM) Roofing
076200 - Sheet Metal Flashing and Trim
077200 - Roof Accessories
078100 - Applied Fire-Resistive Materials
078413 - Through-Penetration Firestop Systems
078446 - Fire Resistive Joint Systems
079200 - Joint Sealants

DIVISION 8 - OPENINGS

081113 - Hollow Metal Doors and Frames
081416 - Wood Doors
081420 - Exterior Clad Wood Doors
083113 - Access Doors
083323 - Overhead Coiling Doors
084113 - Aluminum-Framed Entrances and Storefronts
085250 - Aluminum Clad Wood Windows
086200 - Unit Skylights
087100 - Door Hardware
088000 - Glazing

DIVISION 9 - FINISHES

092500 - Exterior Gypsum Sheathing
092950 - Gypsum Board Assemblies
093100 - Tile
095113 - Acoustical Panel Ceilings
096400 - Wood Flooring
096500 - Resilient Flooring
096800 - Carpet
099000 - Painting

DIVISION 10 - SPECIALTIES

102800 - Toilet and Bath Accessories
103100 - Manufactured Fireplaces
104400 - Fire-Protection Specialties
105500 - Postal Specialties
108500 - Building Specialties

DIVISION 11 - EQUIPMENT

NOT USED

DIVISION 12 - FURNISHINGS

124813 – Entrance Mats and Frames

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

DIVISION 13 - SPECIAL CONSTRUCTION

NOT USED

DIVISION 14 - CONVEYING SYSTEMS

142100 - Electric Traction Elevators

DIVISION 21 - FIRE SUPPRESSION

211313 – Wet-Pipe Sprinkler Systems

DIVISION 22 - PLUMBING

220000 – Design Build: Requirements within

DIVISION 23 - HEATING VENTILATING AND AIR CONDITIONING

230000 – Design Build: Requirements within

DIVISION 26 - ELECTRICAL

260000 – General Electrical Requirements
260516 – Low-Voltage Electrical Power Conductors and Cables
260526 – Grounding and Bonding for Electrical Systems
260533 – Raceways and Boxes for Electrical Systems
260553 – Identification for Electrical Systems
260924 – Lighting Control Devices
261900 – Supporting Devices
262416 – Panelboards
262713 – Electrical Metering
262726 – Wiring devices
265100 – Interior Lighting
265300 – Exterior Lighting

DIVISION 27 - COMMUNICATIONS

271500 – Communications Horizontal Cabling

DIVISION 28 – ELECTRONIC SAFETY AND SECURITY

283111 – Digital, Addressable Fire Alarm System

DIVISION 31 - EARTHWORK

DIVISION 32 - EXTERIOR IMPROVEMENTS

DIVISION 33 - UTILITIES

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Work under other contracts.
   2. Owner-furnished products.
   3. Use of premises.
   4. Owner's occupancy requirements.
   5. Specification formats and conventions.

B. Related Sections include the following:
   1. Division 01 Section "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.3 WORK UNDER OTHER CONTRACTS

A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract. Coordinate the Work of this Contract with work performed under separate contracts.

1.4 OWNER-FURNISHED PRODUCTS

A. Owner will furnish products indicated and /or as specified. The Work includes providing support systems to receive Owner's equipment.
   1. Owner will arrange for and deliver Shop Drawings, Product Data, and Samples to Contractor.
   2. Owner will arrange and pay for delivery of Owner-furnished items according to Contractor's Construction Schedule, as agreed to by the Owner.
   3. After delivery, Owner will inspect delivered items for damage. Contractor shall be present for and assist in Owner's inspection.
   4. If Owner-furnished items are damaged, defective, or missing, Owner will arrange for replacement.
   5. Owner will arrange for manufacturer's field services and for delivery of manufacturer's warranties to Contractor.
   6. Owner will furnish Contractor the earliest possible delivery date for Owner-furnished products. Using Owner-furnished earliest possible delivery dates, Contractor shall designate delivery dates of Owner-furnished items in Contractor's Construction Schedule.
   7. Contractor shall review Shop Drawings, Product Data, and Samples and return them to Architect noting discrepancies or anticipated problems in use of product.
   8. Contractor is responsible for receiving, unloading, and handling Owner-furnished items at Project site.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

9. Contractor is responsible for protecting Owner-furnished items from damage during storage and handling, including damage from exposure to the elements.
10. If Owner-furnished items are damaged as a result of Contractor's operations, Contractor shall repair or replace them at no additional cost to the Owner.
11. Contractor shall install and otherwise incorporate Owner-furnished items into the Work.

1.5 USE OF PREMISES

A. General: Contractor shall have full use of premises for construction operations, including use of Project site, during construction period. Contractor's use of premises is limited only by Owner's right to perform work or to retain other contractors on portions of Project.
   1. Driveways and Entrances: Keep adjacent roadways, driveways, parking, and entrances serving premises clear and available to Owner, Owner's employees, traffic, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
      a. Schedule deliveries to minimize use of driveways and entrances.
      b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

B. The Contractor shall supervise the actions of employees and subcontactors with regard to inappropriate activity at the site. Comply with the following requirements:
   1. Sexual harassment of any nature will not be tolerated.
   2. No pornography on property.
   3. No drugs on property.
   4. No guns or weapons on property.
   5. Failure to comply with the requirements outlined above will result in immediate action as directed by the Owner.
      a. First Offense: The individual removed permanently from premises.
      b. Second Offense: The responsible subcontractor removed permanently from premises.

1.6 OWNER'S OCCUPANCY REQUIREMENTS

A. Owner Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed areas of building, before Substantial Completion, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and partial occupancy shall not constitute acceptance of the total Work.
   1. Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied before Owner occupancy.
   2. Contractor shall obtain a Certificate of Occupancy from authorities having jurisdiction before Owner occupancy.
   3. Before partial Owner occupancy, mechanical and electrical systems shall be operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of building.
   4. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of building.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1.7 SPECIFICATION FORMATS AND CONVENTIONS

A. Specification Format: The Specifications are organized into Divisions and Sections using the 33-division format and CSI's "2004 MasterFormat" numbering system.
   1. Section Identification: The Specifications use Section numbers and titles to help cross-referencing in the Contract Documents. Sections in the Project Manual are in numeric sequence; however, the sequence is incomplete because all available Section numbers are not used. Consult the table of contents at the beginning of the Project Manual to determine numbers and names of Sections in the Contract Documents.
   2. Division 01: Sections in Division 01 govern the execution of the Work of all Sections in the Specifications.

B. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
   1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.
   2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.
      a. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

1.8 MISCELLANEOUS PROVISIONS

A. Material safety data sheets shall be made available in accordance with OSHA requirements.

B. No asbestos containing materials shall be used in the work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

B. Related Sections include the following:
1. Division 01 Section "Quality Requirements" for submitting test and inspection reports and for mockup requirements.
2. Division 01 Section "Closeout Procedures" for submitting warranties.
3. Division 01 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
4. Division 01 Section "Operation and Maintenance Data" for submitting operation and maintenance manuals.
5. Division 01 Section "Demonstration and Training" for submitting video disks of demonstration of equipment and training of Owner's personnel.
6. Divisions 02 through 33 Sections for specific requirements for submittals in those Sections.

1.3 DEFINITIONS

A. Action Submittals: Written and graphic information that requires Architect's responsive action.

B. Informational Submittals: Written information that does not require Architect's responsive action. Submittals may be rejected for not complying with requirements.

1.4 SUBMITTAL PROCEDURES

A. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
    a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

B. Submittals Schedule: Comply with requirements in Division 01 Section "Construction Progress Documentation" for list of submittals and time requirements for scheduled performance of related construction activities.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

C. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
   1. Initial Review: Allow 15 days minimum for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
   2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
   3. Resubmittal Review: Allow 15 days minimum for review of each resubmittal.
   4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 days minimum for initial review of each submittal.
      a. Submittals that require sequential review include, but are not limited to the following components of the Work:
         1) Concrete.
         2) Masonry.
         3) Structural.
         4) Doors, frames and door hardware.
         5) Mechanical.
         6) Electrical.
         7) Plumbing.
         8) Fire Protection.
         9) Civil Engineering.
         10) Landscape Architecture.

D. Identification: Place a permanent label or title block on each submittal for identification.
   1. Indicate name of firm or entity that prepared each submittal on label or title block.
   2. Provide a space approximately 6 by 8 inches on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
   3. Include the following information on label for processing and recording action taken:
      a. Project name.
      b. Date.
      c. Name and address of Architect.
      d. Name and address of Contractor.
      e. Name and address of subcontractor.
      f. Name and address of supplier.
      g. Name of manufacturer.

      h. Submittal number or other unique identifier, including revision identifier.
         1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 061000.01.A).
      i. Number and title of appropriate Specification Section.
      j. Drawing number and detail references, as appropriate.
      k. Location(s) where product is to be installed, as appropriate.
      l. Other necessary identification.

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

E. Deviations: Encircle or otherwise specifically identify deviations from the Contract Documents on submittals.

F. Additional Copies: Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.
1. Additional copies submitted for maintenance manuals shall be marked with action taken.

G. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will return submittals, without review, received from sources other than Contractor.
1. Transmittal Form: Provide locations on form for the following information:
   a. Project name.
   b. Date.
   c. Destination (To:).
   d. Source (From:).
   e. Names of subcontractor, manufacturer, and supplier.
   f. Category and type of submittal.
   g. Submittal purpose and description.
   h. Specification Section number and title.
   i. Drawing number and detail references, as appropriate.
   j. Transmittal number, numbered consecutively.
   k. Submittal and transmittal distribution record.
   l. Remarks.
   m. Signature of transmitter.
2. On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same label information as related submittal.

H. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block and clearly indicate extent of revision.
3. Resubmit submittals until they are approved.

I. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

J. Use for Construction: Use only final submittals with mark indicating approval taken by Architect.

1.5 CONTRACTOR'S USE OF ARCHITECT'S CAD FILES

A. General: At Contractor's written request, copies of Architect's CAD files will be provided at the cost of preparation to Contractor for Contractor's use in connection with Project, subject to the terms and conditions of a Contractor’s Use of Cadd Files Agreement that includes the following conditions:

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1. At cost of production, contractor may obtain copies of Architect's CAD drawings.
2. Architect's CAD drawings are not Contract Documents.
3. Use of Architect's CAD drawings is solely for the convenience of the contractor. Architect's CAD drawings shall be compared to the Contract Documents to the same extent that submittal drawing preparation would require.
4. Contractor's use of Architect's CAD drawings shall in no way relieve the contractor of the requirement to comply with the contract documents.
5. Contractor's use of Architect's CAD drawings does not in any way alter the contractor's obligation for coordination and for the means and methods of construction..

PART 2 - PRODUCTS

2.1 ACTION SUBMITTALS

A. General: Prepare and submit Action Submittals required by individual Specification Sections.
   1. Mark with dark colored pen that permits black and white printing. Do not use highlighter.

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
   1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
   2. Mark each copy of each submittal to show which products and options are applicable.
   3. Include the following information, as applicable:
      a. Manufacturer's written recommendations.
      b. Manufacturer's product specifications.
      c. Manufacturer's installation instructions.
      d. Standard color charts.
      e. Manufacturer's catalog cuts.
      f. Wiring diagrams showing factory-installed wiring.
      g. Printed performance curves.
      h. Operational range diagrams.
      i. Mill reports.
      j. Standard product operation and maintenance manuals.
      k. Compliance with specified referenced standards.
      l. Testing by recognized testing agency.
      m. Application of testing agency labels and seals.
      n. Notation of coordination requirements.
   4. Submit Product Data before or concurrent with Samples.
   5. Number of Copies: Electronically submit each submittal separately in .pdf format to Architect.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
   1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
      a. Dimensions.
      b. Identification of products.
      c. Fabrication and installation drawings.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

d. Roughing-in and setting diagrams.
e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
f. Shopwork manufacturing instructions.
g. Templates and patterns.
h. Schedules.
i. Design calculations.
j. Compliance with specified standards.
k. Notation of coordination requirements.
l. Notation of dimensions established by field measurement.
m. Relationship to adjoining construction clearly indicated.
n. Seal and signature of professional engineer if specified.
o. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.

2. Submit Copies: Electronically submit each submittal separately in .pdf format to Architect.

D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.

1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
2. Identification: Attach label on unexposed side of Samples that includes the following:
   a. Generic description of Sample.
   b. Product name and name of manufacturer.
   c. Sample source.
   d. Number and title of appropriate Specification Section.
3. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
   a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
   b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
4. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
   a. Number of Samples: Submit two full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
5. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
   a. Number of Samples: Submit two sets of Samples. Architect will retain one Sample set; remainder will be returned.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

E. Product Schedule or List: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
1. Type of product. Include unique identifier for each product.
2. Number and name of room or space.
3. Location within room or space.
4. Number of Copies: Electronically submit each submittal separately in .pdf format to Architect.
a. Retain one returned copy as a Project Record Document.

F. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
1. Name, address, and telephone number of entity performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.
3. Drawing number and detail references, as appropriate, covered by subcontract.
4. Electronically submit separately in .pdf format to Architect. will return one copy.
a. Tetain one returned copy as a Project Record Document.

2.2 INFORMATIONAL SUBMITTALS

A. General: Prepare and submit Informational Submittals required by other Specification Sections.
1. Number of Copies: Submit two copies of each submittal, unless otherwise indicated. Architect will not return copies.
2. Certificates and Certifications: Provide a notarized statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
3. Test and Inspection Reports: Comply with requirements specified in Division 01 Section "Quality Requirements."

B. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

C. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on AWS forms. Include names of firms and personnel certified.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

D. Installer Certificates: Prepare written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

E. Manufacturer Certificates: Prepare written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

F. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

G. Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

H. Material Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

I. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

J. Research/Evaluation Reports: Prepare written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
   1. Name of evaluation organization.
   2. Date of evaluation.
   3. Time period when report is in effect.
   4. Product and manufacturers' names.
   5. Description of product.
   6. Test procedures and results.
   7. Limitations of use.

K. Schedule of Tests and Inspections: Comply with requirements specified in Division 1 Section "Quality Requirements."

L. Preconstruction Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

M. Compatibility Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

N. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

O. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements specified in Division 01 Section "Operation and Maintenance Data."

P. Design Data: Prepare written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

Q. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, as applicable:
1. Preparation of substrates.
2. Required substrate tolerances.
3. Sequence of installation or erection.
4. Required installation tolerances.
5. Required adjustments.
6. Recommendations for cleaning and protection.

R. Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections. Include the following, as applicable:
1. Name, address, and telephone number of factory-authorized service representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

S. Insurance Certificates and Bonds: Prepare written information indicating current status of insurance or bonding coverage. Include name of entity covered by insurance or bond, limits of coverage, amounts of deductibles, if any, and term of the coverage.

T. Material Safety Data Sheets (MSDSs): Submit information directly to Owner at end of the project; do not submit to Architect. Maintain copy at the site for the duration of the construction.
1. Architect will not review submittals that include MSDSs and will return them.

2.3 DELEGATED DESIGN

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

B. Delegated-Design Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit three copies of a statement, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
   1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
   1. The Contractor shall review submittals for completeness and compliance with the Contract Documents. If submittal contains substitutions, Contractor shall process substitutions in accordance with Division 01 Section “Substitutions and Product Options,” and not part of specified Shop Drawings or Product Data submittals. Contractor is responsible for keeping Subcontractors on time with the submittal schedule. If the Contractor submits submittals that are repeatedly rejected, requiring the Architect to perform multiple reviews of the same submittal because of the failure to properly prepare and complete the submittals:
      a. Owner will compensate Architect for such additional services.
      b. Owner will deduct the amount of such compensation from the final payment to the Contractor.

B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S ACTION

A. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action. Incomplete submittals will not be reviewed.

B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken.

C. The Architect’s marking of “Approved,” Approved as Noted,” “No Exceptions Taken” or similar verbiage means submittal has been reviewed for general conformance to the contract documents only and does not mean unqualified acceptance. The Contractor is fully responsible for compliance with the contract documents.

D. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

E. Partial submittals are not acceptable, will be considered non-responsive, and will be returned without review.

F. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

END OF SECTION 013300

62 India Str
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Inspections Division
Approved with Conditions
Date: 04/11/17

SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
   1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
   2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
   3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

C. Related Sections include the following:
   1. Divisions 02 through 33 Sections for specific test and inspection requirements.

1.3 DEFINITIONS

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.

C. Mockups: Full-size, physical assemblies that are constructed on-site. Mockups are used to verify selections made under sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not Samples.

D. Laboratory Mockups: Full-size, physical assemblies that are constructed at testing facility to verify performance characteristics.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

E. Preconstruction Testing: Tests and inspections that are performed specifically for the Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.

F. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with industry standards.

G. Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.

H. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

I. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

J. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
   1. Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespeople of the corresponding generic name.

K. Experienced: When used with an entity, "experienced" means having successfully completed a minimum of five previous projects similar in size and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.4 CONFLICTING REQUIREMENTS

A. General: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Architect for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.5 SUBMITTALS

A. Qualification Data: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

B. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
   1. Specification Section number and title.
   2. Description of test and inspection.
   3. Identification of applicable standards.
   4. Identification of test and inspection methods.
   5. Number of tests and inspections required.
   6. Time schedule or time span for tests and inspections.
   7. Entity responsible for performing tests and inspections.
   8. Requirements for obtaining samples.
   9. Unique characteristics of each quality-control service.

C. Reports: Prepare and submit certified written reports that include the following:
   1. Date of issue.
   2. Project title and number.
   3. Name, address, and telephone number of testing agency.
   4. Dates and locations of samples and tests or inspections.
   5. Names of individuals making tests and inspections.
   6. Description of the Work and test and inspection method.
   7. Identification of product and Specification Section.
   8. Complete test or inspection data.
   9. Test and inspection results and an interpretation of test results.
   10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
   11. Comments or professional opinion on whether tested or inspected Work and materials complies with the Contract Document requirements.
   12. Name and signature of laboratory inspector.
   13. Recommendations on retesting and reinspecting.

D. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.6 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this Article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

C. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar to those indicated for this Project in material, design, and extent.

F. Specialists: Certain sections of the Specifications require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
   1. Requirement for specialists shall not supersede building codes and regulations governing the Work.

G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 548; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.
   1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
   2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

H. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

I. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
   1. Contractor responsibilities include the following:
      a. Provide test specimens representative of proposed products and construction.
      b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
      c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
      d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
      e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
      f. When testing is complete, remove test specimens, assemblies, mockups, and laboratory mockups; do not reuse products on Project.
   2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

J. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
3. Demonstrate the proposed range of aesthetic effects and workmanship.
4. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
   a. Allow seven days for initial review and each re-review of each mockup.
5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
6. Demolish and remove mockups when directed, unless otherwise indicated.

K. Laboratory Mockups: Comply with requirements of preconstruction testing and those specified in individual Sections in Divisions 02 through 33.

1.7 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
   1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
   2. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.

B. Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction.
   1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
      a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
   2. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
   3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
   4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
   5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Division 01 Section "Submittal Procedures."

D. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

E. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
   1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
   2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
   3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
   4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
   5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
   6. Do not perform any duties of Contractor.

F. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
   1. Access to the Work.
   2. Incidental labor and facilities necessary to facilitate tests and inspections.
   3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
   4. Facilities for storage and field curing of test samples.
   5. Delivery of samples to testing agencies.
   6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
   7. Security and protection for samples and for testing and inspecting equipment at Project site.

G. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
   1. Schedule times for tests, inspections, obtaining samples, and similar activities.

H. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Submit schedule within 30 days of date established for commencement of the Work.
   1. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.8 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Owner will engage a qualified special inspector to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, in compliance with the IBC Code.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Prepare a record of tests and inspections. Include the following:
   1. Date test or inspection was conducted.
   2. Description of the Work tested or inspected.
   3. Date test or inspection results were transmitted to Architect.
   4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and modifications as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

3.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
   1. Provide materials and comply with installation requirements specified in other Specification Sections. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible.
   2. Comply with the Contract Document requirements for Division 01 Section "Cutting and Patching."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 014000

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

SECTION 014200 - REFERENCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.

C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."

D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.

H. "Provide": Furnish and install, complete and ready for the intended use.

I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.3 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
   1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.4 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States."

B. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.
   1. AABC - Associated Air Balance Council; www.aabc.com.
   2. AAMA - American Architectural Manufacturers Association; www.aamanet.org.
   3. AAPFCO - Association of American Plant Food Control Officials; www.aapfco.org.
   4. AASHTO - American Association of State Highway and Transportation Officials; www.transportation.org.
   5. AATCC - American Association of Textile Chemists and Colorists; www.aatcc.org.
   6. ABMA - American Bearing Manufacturers Association; www.americanbearings.org.
   7. ACI - American Concrete Institute; (Formerly: ACI International); www.concrete.org.
   8. ACPA - American Concrete Pipe Association; www.concrete-pipe.org.
   9. AEIC - Association of Edison Illuminating Companies, Inc. (The); www.aeic.org.
   10. AF&PA - American Forest & Paper Association; www.afandpa.org.
   11. AGA - American Gas Association; www.aga.org.
   12. AHAM - Association of Home Appliance Manufacturers; www.aham.org.
   13. AHRI - Air-Conditioning, Heating, and Refrigeration Institute (The); www.ahrinet.org.
   14. AI - Asphalt Institute; www.asphaltinstitute.org.
   15. AIA - American Institute of Architects (The); www.aia.org.
   16. AISC - American Institute of Steel Construction; www.aisc.org.
   17. AISI - American Iron and Steel Institute; www.steel.org.
   18. AITC - American Institute of Timber Construction; www.aitc-glulam.org.
   19. AMCA - Air Movement and Control Association International, Inc.; www.amca.org.
   20. ANSI - American National Standards Institute; www.ansi.org.
   21. AOSA - Association of Official Seed Analysts, Inc.; www.aosaseed.com.
   22. APA - APA - The Engineered Wood Association; www.apawood.org.
   23. APA - Architectural Precast Association; www.archprecast.org.
   24. API - American Petroleum Institute; www.api.org.
   25. ARI - Air-Conditioning & Refrigeration Institute; (See AHRI).
   26. ARI - American Refrigeration Institute; (See AHRI).
   27. ARMA - Asphalt Roofing Manufacturers Association; www.asphaltroofing.org.
   28. ASCE - American Society of Civil Engineers; www.asce.org.

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

29. ASCE/SEI - American Society of Civil Engineers/Structural Engineering Institute; (See ASCE).
30. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers; www.ashrae.org.
31. ASME - ASME International; (American Society of Mechanical Engineers); www.asme.org.
32. ASSE - American Society of Safety Engineers (The); www.asse.org.
33. ASSE - American Society of Sanitary Engineering; www.asse-plumbing.org.
34. ASTM - ASTM International; (American Society for Testing and Materials International); www.astm.org.
35. ATIS - Alliance for Telecommunications Industry Solutions; www.atis.org.
36. AWEA - American Wind Energy Association; www.awea.org.
37. AWI - Architectural Woodwork Institute; www.awinet.org.
38. AWMAC - Architectural Woodwork Manufacturers Association of Canada; www.awmac.com.
39. AWPA - American Wood Protection Association; (Formerly: American Wood-Preservers' Association); www.awpa.com.
40. AWS - American Welding Society; www.aws.org.
41. AWWA - American Water Works Association; www.awwa.org.
42. BHMA - Builders Hardware Manufacturers Association; www.buildershardware.com.
43. BIA - Brick Industry Association (The); www.gobrick.com.
44. BICSI - BICSI, Inc.; www.bicsi.org.
45. BIFMA - BIFMA International; (Business and Institutional Furniture Manufacturer's Association); www.bifma.com.
46. BISSC - Baking Industry Sanitation Standards Committee; www.bissc.org.
47. BOCA - BOCA; (Building Officials and Code Administrators International Inc.); (See ICC).
48. BWF - Badminton World Federation; (Formerly: International Badminton Federation); www.bwfbadminton.org.
49. CDA - Copper Development Association; www.copper.org.
50. CEA - Canadian Electricity Association; www.electricity.ca.
51. CEA - Consumer Electronics Association; www.ce.org.
52. CFFA - Chemical Fabrics & Film Association, Inc.; www.chemicalfabricsandfilm.com.
53. CFSEI - Cold-Formed Steel Engineers Institute; www.cfsei.org.
54. CGA - Compressed Gas Association; www.cganet.com.
55. CIMA - Cellulose Insulation Manufacturers Association; www.cellulose.org.
56. CISCA - Ceilings & Interior Systems Construction Association; www.cisca.org.
57. CISPI - Cast Iron Soil Pipe Institute; www.cispi.org.
58. CLFMI - Chain Link Fence Manufacturers Institute; www.chainlinkinfo.org.
59. CPA - Composite Panel Association; www.pbmdf.com.
60. CRI - Carpet and Rug Institute (The); www.carpet-rug.org.
61. CRRC - Cool Roof Rating Council; www.coolroofs.org.
62. CRSI - Concrete Reinforcing Steel Institute; www.crsi.org.
63. CSA - Canadian Standards Association; www.csa.ca.
64. CSA - CSA International; (Formerly: IAS - International Approval Services); www.csa-international.org.
65. CSI - Construction Specifications Institute (The); www.csinet.org.
66. CSSB - Cedar Shake & Shingle Bureau; www.cedarbureau.org.
67. CTI - Cooling Technology Institute; (Formerly: Cooling Tower Institute); www.cti.org.
68. CWC - Composite Wood Council; (See CPA).

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

69. DASMA - Door and Access Systems Manufacturers Association; www.dasma.com.
70. DHI - Door and Hardware Institute; www.dhi.org.
71. ECA - Electronic Components Association; www.ec-central.org.
72. ECAMA - Electronic Components Assemblies & Materials Association; (See ECA).
73. EIA - Electronic Industries Alliance; (See TIA).
74. EIMA - EIFS Industry Members Association; www.eima.com.
75. EJMA - Expansion Joint Manufacturers Association, Inc.; www.ejma.org.
76. ESD - ESD Association; (Electrostatic Discharge Association); www.esda.org.
77. ESTA - Entertainment Services and Technology Association; (See PLASA).
78. EVO - Efficiency Valuation Organization; www.evo-world.org.
79. FIBA - Federation Internationale de Basketball; (The International Basketball Federation); www.fiba.com.
80. FIVB - Federation Internationale de Volleyball; (The International Volleyball Federation); www.fivb.org.
81. FM Approvals - FM Approvals LLC; www.fmglobal.com.
82. FM Global - FM Global; (Formerly: FMG - FM Global); www.fmglobal.com.
83. FRSA - Florida Roofing, Sheet Metal & Air Conditioning Contractors Association, Inc.; www.floridaroof.com.
84. FSA - Fluid Sealing Association; www.fluidsealing.com.
85. FSC - Forest Stewardship Council U.S.; www.fscus.org.
86. GA - Gypsum Association; www.gypsum.org.
87. GANA - Glass Association of North America; www.glasswebsite.com.
88. GS - Green Seal; www.greenseal.org.
89. HI - Hydraulic Institute; www.pumps.org.
90. HI/GAMA - Hydronics Institute/Gas Appliance Manufacturers Association; (See AHRI).
91. HMMA - Hollow Metal Manufacturers Association; (See NAAMM).
92. HPVA - Hardwood Plywood & Veneer Association; www.hpva.org.
93. HPW - H. P. White Laboratory, Inc.; www.hpwhite.com.
94. IAPSC - International Association of Professional Security Consultants; www.iapsc.org.
95. IAS - International Approval Services; (See CSA).
96. ICBO - International Conference of Building Officials; (See ICC).
97. ICC - International Code Council; www.iccsafe.org.
98. ICEA - Insulated Cable Engineers Association, Inc.; www.icea.net.
99. ICPA - International Cast Polymer Alliance; www.icpa-hq.org.
100. ICRI - International Concrete Repair Institute, Inc.; www.icri.org.
101. IEC - International Electrotechnical Commission; www.iec.ch.
102. IEEE - Institute of Electrical and Electronics Engineers, Inc. (The); www.ieee.org.
103. IES - Illuminating Engineering Society; (Formerly: Illuminating Engineering Society of North America); www.ies.org.
104. IESNA - Illuminating Engineering Society of North America; (See IES).
105. IEST - Institute of Environmental Sciences and Technology; www.iest.org.
106. IGMA - Insulating Glass Manufacturers Alliance; www.igmaonline.org.
107. IGSHPA - International Ground Source Heat Pump Association; www.igshpa.okstate.edu.
108. ILI - Indiana Limestone Institute of America, Inc.; www.iliai.com.
109. Intertek - Intertek Group; (Formerly: ETL SEMCO; Intertek Testing Service NA); www.intertek.com.
110. ISA - International Society of Automation (The); (Formerly: Instrumentation, Systems, and Automation Society); www.isa.org.
111. ISAS - Instrumentation, Systems, and Automation Society (The); (See ISA).

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

112. ISFA - International Surface Fabricators Association; (Formerly: International Solid Surface Fabricators Association); www.isfanow.org.
113. ISO - International Organization for Standardization; www.iso.org.
114. ISSFA - International Solid Surface Fabricators Association; (See ISFA).
115. ITU - International Telecommunication Union; www.itu.int/home.
116. KCMA - Kitchen Cabinet Manufacturers Association; www.kcma.org.
117. LMA - Laminating Materials Association; (See CPA).
118. LPI - Lightning Protection Institute; www.lightning.org.
119. MBMA - Metal Building Manufacturers Association; www.mbma.com.
120. MCA - Metal Construction Association; www.metalconstruction.org.
121. MFMA - Maple Flooring Manufacturers Association, Inc.; www.maplefloor.org.
122. MFMA - Metal Framing Manufacturers Association, Inc.; www.metalframingmfg.org.
123. MHIA - Material Handling Industry of America; www.mhia.org.
124. MIA - Marble Institute of America; www.marble-institute.com.
125. MMPA - Moulding & Millwork Producers Association; (Formerly: Wood Moulding & Millwork Producers Association); www.wmmpa.com.
126. MPI - Master Painters Institute; www.paintinfo.com.
127. MSS - Manufacturers Standardization Society of The Valve and Fittings Industry Inc.; www.mss-hq.org.
128. NAAMM - National Association of Architectural Metal Manufacturers; www.naamm.org.
129. NACE - NACE International; (National Association of Corrosion Engineers International); www.nace.org.
130. NADCA - National Air Duct Cleaners Association; www.nadca.com.
131. NAIMA - North American Insulation Manufacturers Association; www.naima.org.
132. NBGQA - National Building Granite Quarries Association, Inc.; www.nbgqa.com.
133. NCAA - National Collegiate Athletic Association (The); www.ncaa.org.
134. NCMA - National Concrete Masonry Association; www.ncma.org.
135. NEBB - National Environmental Balancing Bureau; www.nebb.org.
136. NECA - National Electrical Contractors Association; www.necanet.org.
137. NeLMA - Northeastern Lumber Manufacturers Association; www.nelma.org.
138. NEMA - National Electrical Manufacturers Association; www.nema.org.
139. NETA - InterNational Electrical Testing Association; www.netaworld.org.
140. NFHS - National Federation of State High School Associations; www.nfhs.org.
141. NFPA - NFPA; (National Fire Protection Association); www.nfpa.org.
142. NFPA - NFPA International; (See NFPA).
143. NFRC - National Fenestration Rating Council; www.nfrc.org.
144. NHLA - National Hardwood Lumber Association; www.nhla.com.
145. NLGA - National Lumber Grades Authority; www.nlga.org.
146. NOFMA - National Oak Flooring Manufacturers Association; (See NWFA).
147. NOMMA - National Ornamental & Miscellaneous Metals Association; www.nomma.org.
148. NRCA - National Roofing Contractors Association; www.nrca.net.
149. NRMCA - National Ready Mixed Concrete Association; www.nrmca.org.
150. NSF - NSF International; (National Sanitation Foundation International); www.nsf.org.
151. NSPE - National Society of Professional Engineers; www.nspe.org.
152. NSSGA - National Stone, Sand & Gravel Association; www.nssga.org.
153. NTMA - National Terrazzo & Mosaic Association, Inc. (The); www.ntma.com.
154. NWFA - National Wood Flooring Association; www.nwfa.org.
155. PCI - Precast/Prestressed Concrete Institute; www.pci.org.
156. PDI - Plumbing & Drainage Institute; www.pdionline.org.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

157. PLASA - PLASA; (Formerly: ESTA - Entertainment Services and Technology Association); www.plasa.org.
158. RCSC - Research Council on Structural Connections; www.boltcouncil.org.
159. RFCI - Resilient Floor Covering Institute; www.rfci.com.
160. RIS - Redwood Inspection Service; www.redwoodinspection.com.
161. SAE - SAE International; (Society of Automotive Engineers); www.sae.org.
162. SCTE - Society of Cable Telecommunications Engineers; www.scte.org.
163. SDI - Steel Deck Institute; www.sdi.org.
164. SDI - Steel Door Institute; www.steeldoor.org.
165. SEFA - Scientific Equipment and Furniture Association; www.sefalabs.com.
166. SEI/ASCE - Structural Engineering Institute/American Society of Civil Engineers; (See ASCE).
167. SIA - Security Industry Association; www.siaonline.org.
168. SJI - Steel Joist Institute; www.steeljoist.org.
169. SMA - Screen Manufacturers Association; www.smainfo.org.
170. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association; www.smacna.org.
171. SMPTE - Society of Motion Picture and Television Engineers; www.smpte.org.
172. SPFA - Spray Polyurethane Foam Alliance; www.sprayfoam.org.
173. SPIB - Southern Pine Inspection Bureau; www.spib.org.
174. SPRI - Single Ply Roofing Industry; www.spri.org.
175. SRCC - Solar Rating and Certification Corporation; www.solar-rating.org.
176. SSINA - Specialty Steel Industry of North America; www.ssina.com.
177. SSPC - SSPC: The Society for Protective Coatings; www.sspc.org.
178. STI - Steel Tank Institute; www.steeltank.com.
179. SWI - Steel Window Institute; www.steelwindows.com.
180. SWPA - Submersible Wastewater Pump Association; www.swpa.org.
181. TCA - Tilt-Up Concrete Association; www.tilt-up.org.
182. TCNA - Tile Council of North America, Inc.; (Formerly: Tile Council of America); www.tileusa.com.
183. TEMA - Tubular Exchanger Manufacturers Association, Inc.; www.tema.org.
184. TIA - Telecommunications Industry Association; (Formerly: TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance); www.tiaonline.org.
185. TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance; (See TIA).
186. TMS - The Masonry Society; www.masonrysociety.org.
187. TPI - Truss Plate Institute; www.tpinst.org.
188. TPI - Turfgrass Producers International; www.turfgrasssod.org.
189. TRI - Tile Roofing Institute; www.tileroofing.org.
190. UBC - Uniform Building Code; (See ICC).
191. UL - Underwriters Laboratories Inc.; www.ul.com.
192. UNI - Uni-Bell PVC Pipe Association; www.uni-bell.org.
193. USAV - USA Volleyball; www.usavolleyball.org.
194. USGBC - U.S. Green Building Council; www.usgbc.org.
195. USITT - United States Institute for Theatre Technology, Inc.; www.usitt.org.
196. WASTEC - Waste Equipment Technology Association; www.wastec.org.
197. WCLIB - West Coast Lumber Inspection Bureau; www.wclib.org.
198. WCMA - Window Covering Manufacturers Association; www.wcmanet.org.
199. WDMA - Window & Door Manufacturers Association; www.wdma.com.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

200. WI - Woodwork Institute; (Formerly: WIC - Woodwork Institute of California); www.wicnet.org.
201. WMMPA - Wood Moulding & Millwork Producers Association; (See MMPA).
202. WSRCA - Western States Roofing Contractors Association; www.wsrca.com.
203. WPA - Western Wood Products Association; www.wwpa.org.

C. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is believed to be accurate as of the date of the Contract Documents.
1. DIN - Deutsches Institut fur Normung e.V.; www.din.de.
2. IAPMO - International Association of Plumbing and Mechanical Officials; www.iapmo.org.
3. ICC - International Code Council; www.iccsafe.org.
4. ICC-ES - ICC Evaluation Service, LLC; www.icc-es.org.

D. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Information is subject to change and is up-to-date as of the date of the Contract Documents.
1. COE - Army Corps of Engineers; www.usace.army.mil.
2. CPSC - Consumer Product Safety Commission; www.cpsc.gov.
3. DOC - Department of Commerce; National Institute of Standards and Technology; www.nist.gov.
4. DOD - Department of Defense; http://dodssp.daps.dla.mil.
5. DOE - Department of Energy; www.energy.gov.
6. EPA - Environmental Protection Agency; www.epa.gov.
7. FAA - Federal Aviation Administration; www.faa.gov.
8. FG - Federal Government Publications; www.gpo.gov.
9. GSA - General Services Administration; www.gsa.gov.
10. HUD - Department of Housing and Urban Development; www.hud.gov.
11. LBL - Lawrence Berkeley National Laboratory; Environmental Energy Technologies Division; http://eetd.lbl.gov.
12. OSHA - Occupational Safety & Health Administration; www.osha.gov.
13. SD - Department of State; www.state.gov.
14. TRB - Transportation Research Board; National Cooperative Highway Research Program; www.trb.org.
15. USDA - Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; www.ars.usda.gov.
16. USDA - Department of Agriculture; Rural Utilities Service; www.usda.gov.
17. USDJ - Department of Justice; Office of Justice Programs; National Institute of Justice; www.ojp.usdoj.gov.
18. USP - U.S. Pharmacopeia; www.usp.org.
19. USPS - United States Postal Service; www.usps.com.

E. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.
1. CFR - Code of Federal Regulations; Available from Government Printing Office; www.gpo.gov/fdsys.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

2. DOD - Department of Defense; Military Specifications and Standards; Available from Department of Defense Single Stock Point; http://dodssp.daps.dla.mil.
3. DSCC - Defense Supply Center Columbus; (See FS).
4. FED-STD - Federal Standard; (See FS).
5. FS - Federal Specification; Available from Department of Defense Single Stock Point; http://dodssp.daps.dla.mil.
   a. Available from Defense Standardization Program; www.dsp.dla.mil.
   b. Available from General Services Administration; www.gsa.gov.
   c. Available from National Institute of Building Sciences/Whole Building Design Guide; www.wbdg.org/ccb.
6. MILSPEC - Military Specification and Standards; (See DOD).
7. USAB - United States Access Board; www.access-board.gov.
8. USATBCB - U.S. Architectural & Transportation Barriers Compliance Board; (See USAB).

F. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.
1. CBHF - State of California; Department of Consumer Affairs; Bureau of Electronic Appliance and Repair, Home Furnishings and Thermal Insulation; www.bearhfti.ca.gov.
2. CCR - California Code of Regulations; Office of Administrative Law; California Title 24 Energy Code; www.calregs.com.
3. CDHS - California Department of Health Services; (See CDPH).
4. CDPH - California Department of Public Health; Indoor Air Quality Program; www.cal-iaq.org.
5. CPUC - California Public Utilities Commission; www.cpuc.ca.gov.
6. SCAQMD - South Coast Air Quality Management District; www.aqmd.gov.
7. TFS - Texas Forest Service; Forest Resource Development and Sustainable Forestry; http://txforestservice.tamu.edu.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014200

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; product substitutions; and comparable products.

B. Related Sections include the following:
1. Division 01 Section "References" for applicable industry standards for products specified.
2. Division 01 Section “Substitutions and Product Options” for procedures and requirements for product substitutions.
3. Division 01 Section "Closeout Procedures" for submitting warranties for Contract closeout.
4. Divisions 02 through 33 Sections for specific requirements for warranties on products and installations specified to be warranted.

1.3 DEFINITIONS

A. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility, except that products consisting of recycled-content materials are allowed, unless explicitly stated otherwise. Products salvaged or recycled from other projects are not considered new products.
3. Comparable Product: Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

C. Basis-of-Design Product Specification: Where a specific manufacturer's product is named and accompanied by the words "basis of design," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other named manufacturers.

1.4 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.
   1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
   2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.

B. Delivery and Handling:
   1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
   2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
   3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
   4. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.

C. Storage:
   1. Store products to allow for inspection and measurement of quantity or counting of units.
   2. Store materials in a manner that will not endanger Project structure.
   3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
   4. Store cementitious products and materials on elevated platforms.
   5. Store foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
   6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
   7. Protect stored products from damage and liquids from freezing.
   8. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.6 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.
1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included with the Specifications, prepare a written document using appropriate form properly executed.
3. Refer to Divisions 2 through 16 Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Division 01 Section "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, that are new at time of installation.
1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Where products are accompanied by the term "match sample," sample to be matched is Architect's.
6. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.
7. Or Equal: Where products are specified by name and accompanied by the term "or equal" or "or approved equal" or "or approved," comply with provisions in Division 01 Section “Substitutions and Product Options” to obtain approval for use of an unnamed product.

B. Product Selection Procedures:
1. Product: Where Specifications name a single product and manufacturer, provide the named product that complies with requirements.
2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements.
3. Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed that complies with requirements.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

4. Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements.
5. Available Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed, that complies with requirements. .
6. Available Manufacturers: Where Specifications include a list of manufacturers, provide a product by one of the manufacturers listed, that complies with requirements.
7. Product Options: Where Specifications indicate that sizes, profiles, and dimensional requirements on Drawings are based on a specific product or system, provide the specified product or system. Comply with provisions in Division 01 Section "Substitutions and Product Options" for consideration of an unnamed product or system.
8. Basis-of-Design Product: Where Specifications name a product and include a list of manufacturers, provide the specified product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with provisions in Division 01 Section "Substitutions and Product Options" for consideration of an unnamed product by the other named manufacturers.
9. Visual Matching Specification: Where Specifications require matching an established Sample, select a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
    a. If no product available within specified category matches and complies with other specified requirements, comply with Division 01 Section "Substitutions and Product Options" for proposal of product.
10. Visual Selection Specification: Where Specifications include the phrase "as selected from manufacturer's colors, patterns, textures" or a similar phrase, select a product that complies with other specified requirements.
    a. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, density, or texture from manufacturer's product line that does not include premium items.
    b. Full Range: Where Specifications include the phrase "full range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

SECTION 016300 - SUBSTITUTIONS AND PRODUCT OPTIONS

PART 1 GENERAL

1.1 DESCRIPTION

A. Substitution procedures during the bid period shall be followed to provide equality of bids. Substitutions approved by the Architect will be issued by addendum during the bid period. Substitutions not approved by addendum shall not be included in the bid. Contractors submitting substitutions after bids are received will not be given additional compensation for rejected submittals.

1.2 SUBSTITUTIONS

A. Submit two copies of request for substitution. Include in the request:
   1. Complete data substantiating compliance of proposed substitution with Contract Documents.
   2. For Products:
      a. Product identification including manufacturer's name and address.
      b. Manufacturer's Literature:
         (1) Product description.
         (2) Performance and test data.
         (3) Reference standards.
      c. Samples.
      d. Name and address of similar projects on which product was used, and date of installation.
   3. Itemized comparison of product substitution with product specified.
   4. Changes in construction schedule.
   5. Accurate cost data on proposed substitution in comparison with product specified.

B. In Making Request for Substitution, the Contractor Represents:
   1. Contractor has investigated proposed product or method and determined that it is equal or superior in all respects to that specified.
   2. Contractor will provide the same or greater guarantee for substitution as for product specified.
   3. Contractor will coordinate installation of accepted substitution into work, making such changes as required for work to be completed.
   4. Contractor waives all claims for additional costs related to substitution in which it becomes apparent before, during or after installation.
   5. Requested substitution is compatible with other portions of the Work. All sizes, dimensions, locations for connections to other items as designed, clearances from building structure and other equipment have been verified and is acknowledged in the substitution request
   6. Contractor requesting substitution shall bear additional costs to all parties due to his substitution, including Architect's fees.

C. Substitutions Will Not Be Considered If:
   1. They are indicated or implied on shop drawings or project submittals without formal

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

request.

2. Acceptance will require substantial revision of Contract Documents.
3. Not readily serviceable in the area or may cause the Owner to stock extra parts.

D. Substitutions not approved before the last addendum is distributed shall not be considered in the Base Bid.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

END OF SECTION 016300

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Inspections Division
Approved with Conditions
Date: 04/11/17

SUBSTITUTION REQUEST FORM

Project: _____ Substitution Request Number:_____
To: _____ From: _____
Re: _____ Date: _____
Specification Title: _____ Description: _____

Section: _____ Page: _____ Article/Paragraph: _____

Proposed Substitution: _____

Manufacturer: _____Address: _____ Phone: _____
Trade Name: _____Model No. _____
Attached data includes product description, specifications, drawings, cost data, and performance and test data adequate for evaluation of the request: applicable portions of the data are clearly identified.

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

Attached data includes a detailed itemized comparison list of product substitution with product specified.

The Undersigned certifies:

1. Has investigated proposed Product and determined that it meets or exceeds the quality level of the specified product.
2. Will provide the same warranty for the Substitution as for the specified Product.
3. Will coordinate installation and make changes to other Work that may be required for the Work to be complete with no additional cost to Owner. All sizes, dimensions, locations for connections to other items as designed, clearances from building structure and other equipment have been verified.
4. Will remove substitution and pay all costs if differences discovered later that were not identified on the substitution request are found that make the substitution unacceptable with no additional cost to Owner.
5. Waive claims for additional costs or time extension that may subsequently become apparent.
6. Will reimburse Owner and Architect/Engineer for review or redesign services associated with substitution.
7. They are authorized to sign this form for the product manufacturer, and commit to the terms of Section ASubstitutions and Product Options,@ and this substitution request form.

Submitted By: _____

Signed By: _____

Firm: _____

Address: _____

Telephone: _____ Fax: _____

A/E=s REVIEW AND ACTION

☐ Submission approved - Make submittals in accordance with Specification Section 013300.
☐ Submission approved as noted - Make submittals in accordance with Specification Section 013300.
☐ Submission rejected - Use specified materials.
☐ Submission request received too late - Use specified materials.

Signed by: _____ Date: _____
.

Supporting Data Attached:

☐ Drawings ☐ Product Data ☐ Samples ☐ Tests ☐ Reports
☐ Comparison list ☐ Other

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
   1. Inspection procedures.
   2. Warranties.
   3. Final cleaning.

B. Related Sections include the following:
   1. Division 01 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
   2. Division 01 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
   3. Division 01 Section "Demonstration and Training" for requirements for instructing Owner's personnel.
   4. Divisions 02 through 33 Sections for specific closeout and special cleaning requirements for the Work in those Sections.

1.3 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, the Contractor shall complete the following. List items below that are incomplete in request.
   1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
   2. Advise Owner of pending insurance changeover requirements.
   3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
   4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
   5. Prepare and submit Project Record Documents, operation and maintenance manuals, and similar final record information.
   6. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
   7. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
   8. Complete startup testing of systems.
   9. Submit test/adjust/balance records.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

10. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
11. Advise Owner of changeover in heat and other utilities.
12. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
13. Complete final cleaning requirements, including touchup painting. Wipe down equipment, including mechanical, electrical and teldata equipment in public areas and equipment rooms.
14. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
15. Submit initial draft copy of operation and maintenance manuals at least 15 days before requesting inspection for Substantial Completion.

B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
   1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
   2. Results of completed inspection will form the basis of requirements for Final Completion.

1.4 FINAL COMPLETION

A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:
   1. Submit a final Application for Payment according to Division 01 Section "Payment Procedures."
   2. Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
   3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
   4. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
   5. Extra materials, spares and attic stock have been turned over to the Owner.
   6. Demonstration and training is complete.
   7. Final copies of operation and maintenance manuals have been delivered to the Owner.
   8. All warranties have been submitted.
   9. Final record documents have been delivered to the Architect.
   10. Notarized certificate affirming that no asbestos containing materials were incorporated into the Work.

B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.5 INSPECTION FEES

A. If Architect Performs Reinspections Due to Failure of Work to Comply with the Claims of Status of Completion Made by Contractor, Or, Should Contractor fail to complete the work, Or, Should Contractor fail to promptly correct warranty items or work later found to be deficient:
   1. Owner will compensate Architect for such additional services.
   2. Owner will deduct amount of such compensation from final payment to Contractor.

B. If the Work is not completed by date set in the Agreement, and the Architect needs to perform additional Contract Administrative and on site observation duties:
   1. Owner will compensate Architect for such additional services.
   2. Owner will deduct amount of such compensation from final payment to Contractor.

1.6 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Preparation: List shall be prepared by the Contractor. Submit three copies of list. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
   1. Organize list of spaces in sequential order.
   2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
   3. Include the following information at the top of each page:
      a. Project name.
      b. Date.
      c. Name of Architect.
      d. Name of Contractor.
      e. Page number.
   4. Owner and Architect will supplement list with additional items found incomplete and additional items needing correction.

1.7 WARRANTIES

A. Submittal Time: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated in the contract documents.
   1. Unless indicated otherwise, all warranties shall commence on the date of Substantial Completion.

B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

C. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.
   1. Submit final warranties as a package for the entire project, assembled and identified as described below.

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

2. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
3. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
4. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
5. Electronic Media: Submit copy of warranty binder on CD-R in .PDF format. Bookmark based on the table of contents, and for each warranty within each section.
6. Provide additional copies of each warranty to include in operation and maintenance manuals.

D. Warranty Response Time: The Contract shall respond and begin to take necessary action within 7 days of receipt of written notification from the Owner. Response time for life safety items, and for building perimeter security shall be within 24 hours of receipt of written notification from the Owner.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:
    a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
    b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
    c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

d. Remove tools, construction equipment, machinery, and surplus material from Project site.
e. Remove snow and ice to provide safe access to building.
f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
h. Sweep concrete floors broom clean in unoccupied spaces.
i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
j. Resilient flooring shall be scrubbed and cleaned with cleaner recommended by the flooring manufacturer just prior to occupation by Owner.
    1) VCT: Clean surface according to manufacturer's requirements and apply 2 coats of high quality cross-linked acrylic floor polish. Coordinate polish product with Owner's maintenance system.
k. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces. Cleaning of windows shall be done just before Owner occupancy.
l. Remove labels that are not permanent.
m. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
    1) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.
n. Wipe surfaces of mechanical and electrical equipment, elevator equipment, teldata equipment and similar equipment in public areas and equipment rooms.. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
o. Replace parts subject to unusual operating conditions.
p. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
q. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
r. Clean ducts, blowers, and coils if units were operated without filters during construction.
s. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
t. Leave Project clean and ready for occupancy.

C. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

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62 India Str
Portland, M
DD

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
   1. Operation and maintenance documentation directory.
   2. Operation manuals for systems, subsystems, and equipment.
   3. Maintenance manuals for the care and maintenance of products, materials, and finishes, systems and equipment.

B. Related Sections include the following:
   1. Division 01 Section "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
   2. Division 01 Section "Closeout Procedures" for submitting operation and maintenance manuals.
   3. Division 01 Section "Project Record Documents" for preparing Record Drawings for operation and maintenance manuals.
   4. Divisions 02 through 33 Sections for specific operation and maintenance manual requirements for the Work in those Sections.

1.3 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 SUBMITTALS

A. Initial Submittal: Submit 1 draft copy of each manual at least 15 days before requesting inspection for Substantial Completion. Include a complete operation and maintenance directory. Architect will return one copy of draft and mark whether general scope and content of manual are acceptable.

B. Final Submittal: Submit one copy of each manual in final form at least 15 days before final inspection. Architect will return copy with comments after final inspection.
   1. Correct or modify each manual to comply with Architect's comments. Submit copy of each corrected manual within 15 days of receipt of Architect's comments.
   2. Electronic Media: Submit one copy in PDF format on electronic media with data bookmarked according to the project manual table of contents. Bookmark the listing of documents, systems and equipment.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1.5 COORDINATION

A. Where operation and maintenance documentation includes information on installations by more than one factory-authorized service representative, assemble and coordinate information furnished by representatives and prepare manuals.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. Organization: Include a section in the directory for each of the following:
1. List of documents.
2. List of systems.
3. List of equipment.
4. Subcontractor list.
5. Warranties
6. Table of contents.

B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.

C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.

D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

2.2 MANUALS, GENERAL

A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
1. Title page.
2. Table of contents.
3. Manual contents.

B. Title Page: Enclose title page in transparent plastic sleeve. Include the following information:
1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name, address, and telephone number of Contractor and primary subcontractors.
6. Name and address of Architect.
7. Cross-reference to related systems in other operation and maintenance manuals.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
   1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
   1. Binders: Heavy-duty, D-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents but not greater than 2 inches, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets. Do not over fill D-ring, allowing 1/2-inch space for future additions.
      a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
      b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.
   2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
   3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software diskettes for computerized electronic equipment. Typewritten, drawn or photographic material shall be protected by clear plastic sleeves.
   4. Supplementary Text: Prepared on 8-1/2-by-11-inch white bond paper.
   5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
      a. Maximum size of drawings to be included in the binders shall not exceed 11-by-17-inch. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
      b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and submit envelopes with manual. At appropriate locations in manual, insert typewritten pages indicating envelope, drawing titles, descriptions of contents, and drawing locations.

E. Electronic Media: Submit one copy of each complete manual, including Record Shop Drawings and Product Data on electronic media in .PDF format. Bookmark based on the specifications table of contents and manual dividers.

2.3 OPERATION MANUALS

A. Content: Daily operations and management of systems and equipment. In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
   1. System, subsystem, and equipment descriptions.
   2. Performance and design criteria if Contractor is delegated design responsibility.
   3. Operating standards.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.
11. Emergency operations and shutdown information that must be immediately available during emergency situations to protect life and property and to minimize disruptions to building occupants.

B. Descriptions: Include the following:
1. Product name and model number.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:
1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.4 PRODUCT MAINTENANCE MANUAL

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

C. Product Information: Include the following, as applicable:

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
1. Include procedures to follow and required notifications for warranty claims.
2. These copies of warranties are in addition to the warranty package required in Section 017700 "Closeout Procedures."

2.5 SYSTEMS AND EQUIPMENT MAINTENANCE MANUAL

A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
1. Standard printed maintenance instructions and bulletins.
2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training videotape, if available.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
   1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
   2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
   1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.

B. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

C. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
   1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
   2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

D. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
   1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

E. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in Record Drawings to ensure correct illustration of completed installation.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1. Provide one copy of applicable record drawings in pdf format. Do not use original Project Record Documents as part of operation and maintenance manuals.
2. Comply with requirements of newly prepared Record Drawings in Division 01 Section "Project Record Documents."

F. Comply with Division 01 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 017823

62 India Str
Portland, M
DD

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for Project Record Documents, including the following:
   1. Record Drawings.
   2. Record Specifications.
   3. Record Product Data.
   4. Record Shop Drawings.
   5. Record Test Reports

B. Related Sections include the following:
   1. Division 01 Section "Closeout Procedures" for general closeout procedures.
   2. Division 01 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
   3. Divisions 02 through 33 Sections for specific requirements for Project Record Documents of the Work in those Sections.

1.3 SUBMITTALS

A. Submit all project record documents as one submittal package.

B. Record Drawings: Comply with the following:
   1. Number of Copies: Submit copies of Record Drawings as follows:
      a. Submit one set of marked-up Record Prints. Provide copy of each Drawing, whether or not changes and additional information were recorded.
         1) Electronic Media: Submit one copy in PDF format on electronic media. Bookmark based on the list of drawings.

C. Record Specifications: Submit one hard copy and one copy on electronic media of Project's Specifications, including addenda and contract modifications.
   1. Electronic Media: In addition to paper copy, submit record copy of record specification on electronic media in .PDF format.

D. Record Shop Drawings and Product Data: Submit one hard copy and one copy on electronic media of each Product Data submittal.
   1. Where Record Shop Drawings and Product Data is required as part of operation and maintenance manuals, submit marked-up Shop Drawings and Product Data as an insert in manual instead of submittal as Record Shop Drawings and Product Data. Insert typewritten pages indicating drawing titles, descriptions of contents, and Record Shop Drawings and Product Data locations drawing locations that are part of operation and maintenance manuals.

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

2. Electronic Media: In addition to paper copy, submit record copy of record Shop Drawings and Product Data specification on electronic media in .PDF format. Bookmark Product Data based on the table of contents.

E. Directories: Subcontractor directory.
1. Submit one hard copy and one copy on electronic media electronic media in .PDF format.

F. Record Test Reports: Submit one hard copy and one copy on electronic media of project Test Reports.
1. Electronic Media: In addition to paper copy, submit record copy of record Test Reports on electronic media in .PDF format. Bookmark Test Reports based on the project manual table of contents.

PART 2 - PRODUCTS

2.1 RECORD (AS-BUILT) DRAWINGS

A. Record Prints: Maintain one set of blue- or black-line white prints of the Contract Drawings and Shop Drawings.
1. Preparation: Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.
   a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
   b. Accurately record information in an understandable drawing technique.
   c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
2. Content: Types of items requiring marking include, but are not limited to, the following:
   a. Dimensional changes to Drawings.
   b. Revisions to details shown on Drawings.
   c. Depths of foundations below first floor.
   d. Locations and depths of underground utilities.
   e. Revisions to routing of piping and conduits.
   f. Revisions to electrical circuitry.
   g. Actual equipment locations.
   h. Duct size and routing.
   i. Locations of concealed internal utilities.
   j. Changes made by Change Order or Construction Change Directive.
   k. Changes made following Architect's written orders.
   l. Changes made by field sketches and supplemental drawings.
   m. Changes made as a result of requests for information (RFI's).
   n. Details not on the original Contract Drawings.
   o. Field records for variable and concealed conditions.
   p. Record information on the Work that is shown only schematically.
3. Mark the Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings.

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

4. Mark field record sets during construction with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, Requests for Information (RFI's), and similar identification, where applicable.
7. Mechanical, Electrical and Plumbing record drawings shall be based on record site drawings and record floor plan drawings.

B. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Record Prints: Organize Record Prints into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Electronic Media: Submit one copy in PDF format on electronic media with drawings bookmarked based on the list of drawings.
3. Identification: As follows:
   a. Project name.
   b. Date.
   c. Designation "PROJECT RECORD DRAWINGS."
   d. Name of Architect.
   e. Name of Contractor.

2.2 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions, change orders and product options selected.
3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. For each principal product, indicate whether Record Product Data has been submitted in operation and maintenance manuals instead of submitted as Record Product Data.
5. Note related Change Orders, Record Product Data, Requests for Information (RFI's), and Record Drawings where applicable.
6. Electronic Media: Electronic media in .PDF format. Bookmark based on the project manual table of contents.

2.3 RECORD SHOP DRAWINGS AND PRODUCT DATA

A. Preparation: Mark Shop Drawings and Product Data to indicate the actual product installation where installation varies substantially from that indicated in Shop Drawings and Product Data submittal.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Note related Change Orders, Record Specifications, and Record Drawings where applicable.

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

4. Bind product data in heavy-duty, D-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents but not greater than 2 inches, and sized to receive 8-1/2-by-11-inch paper. Do not over fill D-ring, allowing 1/2 inch space for future additions.
5. Provide heavy paper dividers with plastic-covered tabs for each specification section with product data. Mark tab to identify the specification section. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
6. Identify each binder on the front and spine with the typed or printed title "PRODUCT DATA and SHOP DRAWINGS" Project name, and name of Contractor.
7. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
   a. Maximum size of drawings to be included in the binders shall not exceed 11-by-17-inch. Fold drawings to same size as text pages and use as foldouts.
   b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and submit envelopes with manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations. Fold drawings to fit into letter size storage boxes.
8. Electronic Media: Submit record copy of marked-up Shop Drawings and Product Data on CD-R in .PDF format. Bookmark based on the project manual table of contents, and for each Shop Drawings and Product Data within each section. Where Record Shop Drawings and Product Data is required as part of operation and maintenance manuals, submit electronic media of marked-up Shop Drawings and Product Data as part of manual instead of submittal as Record Shop Drawings and Product Data.

2.4 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

B. Subcontractor Directory: Name, address and telephone number for all major subcontractors, organized by specification section. Provide a separate list in alphabetical order.

C. Test Reports: Provide copy of all project test reports. Bind reports in heavy duty D-ring, vinyl covered, loose leaf binders, thickness as necessary to accommodate contents but not greater than 2 inches, and sized to receive 8-1/2-by-11-inch paper. Provide heavy paper dividers with plastic covered tabs labeled for each specification section. Identify each binder on the front and spine with the typed title “Test Reports” and the project name.
   1. Electronic Media: Submit record copy of Test Reports on electronic media in .PDF format. Bookmark based on the project manual table of contents.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and modifications to Project Record Documents as they occur; do not wait until the end of Project.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

B. Maintenance of Record Documents and Samples: Store Record Documents and Samples in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours.

END OF SECTION 017839

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

SECTION 017900 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
   1. Demonstration of operation of systems, subsystems, and equipment.
   2. Training in operation and maintenance of systems, subsystems, and equipment.

B. Related Sections include the following:
   1. Division 01 Section "Project Management and Coordination" for requirements for preinstruction conferences.
   2. Divisions 02 through 33 Sections for specific requirements for demonstration and training for products in those Sections.

1.3 SUBMITTALS

A. Demonstration and Training: Submit list of systems and equipment to be demonstrated and training provided. Submit training and orientation agenda for each section.

B. At completion of training, submit one complete training/instruction/operation manual(s) for Owner's use.

C. Attendance Record: For each training session, submit list of participants and person(s) providing training.

1.4 QUALITY ASSURANCE

A. Demonstrator and Trainer Qualifications: A factory-authorized service representative, complying with requirements in Division 01 Section "Quality Requirements," experienced in operation and maintenance procedures and training.

1.5 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations.

B. Coordinate providing notification of dates, times, length of instruction time, and training content.

C. Coordinate content of training with content of approved operation and maintenance manuals.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

A. Provide demonstration and training for each system and equipment not part of a system, as required by individual Specification Sections, and applicable items as follows:
   1. Fire-protection systems, including fire alarm, sprinkler and fire-extinguishing systems.
   2. Intrusion detection systems.
   3. Conveying systems, including elevators.
   4. HVAC systems, including instrumentation and controls.
   5. Electrical service and distribution, including switchboards, and panelboards.
   6. Lighting equipment and controls.
   7. Communication systems and equipment, including telephone and communication systems, data system, security system.
   8. Access control system.

B. Demonstration and Training: Include instruction as applicable for the following:
   1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
      a. System, subsystem, and equipment descriptions.
      b. Performance and design criteria if Contractor is delegated design responsibility.
      c. Operating standards.
      d. Regulatory requirements.
      e. Equipment function.
      f. Operating characteristics.
      g. Limiting conditions.
      h. Performance curves.
   2. Documentation: Review the following items in detail:
      a. Operations and maintenance manuals.
      b. Project Record Documents.
      c. Warranties and bonds.
      d. Maintenance service agreements and similar continuing commitments.
      e. Applicable video presentations.
   3. Emergencies: Include the following, as applicable:
      a. Instructions on meaning of warnings, trouble indications, and error messages.
      b. Instructions on stopping.
      c. Shutdown instructions for each type of emergency.
      d. Operating instructions for conditions outside of normal operating limits.
      e. Sequences for electric or electronic systems.
      f. Special operating instructions and procedures.
   4. Operations: Include the following, as applicable:
      a. Instructions on meaning of warnings, trouble indications, and error messages.
      b. Startup procedures.
      c. Equipment or system break-in procedures.
      d. Routine and normal operating instructions.
      e. Regulation and control procedures.
      f. Control sequences.
      g. Safety procedures.
      h. Instructions on stopping.
      i. Normal and emergency shutdown instructions.
      j. Operating procedures for system, subsystem, or equipment failure.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

k. Seasonal and weekend operating instructions.
l. Required sequences for electric or electronic systems.
m. Special operating instructions and procedures.

5. Adjustments: Include the following:
   a. Alignments.
   b. Checking adjustments.
   c. Noise and vibration adjustments.
   d. Economy and efficiency adjustments.
6. Troubleshooting: Include the following:
   a. Diagnostic instructions.
   b. Test and inspection procedures.
7. Maintenance: Include the following:
   a. Inspection procedures.
   b. Types of cleaning agents to be used and methods of cleaning.
   c. List of cleaning agents and methods of cleaning detrimental to product.
   d. Procedures for routine cleaning
   e. Procedures for preventive maintenance.
   f. Procedures for routine maintenance.
   g. Instruction on use of special tools.
8. Repairs: Include the following:
   a. Diagnosis instructions.
   b. Repair instructions.
   c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
   d. Instructions for identifying parts and components.
   e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 PREPARATION

A. Assemble materials necessary for instruction.

3.2 DEMONSTRATION AND TRAINING INSTRUCTION

A. Engage qualified personnel to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
   1. Owner will furnish Contractor with names and positions of participants.

B. Scheduling: Provide demonstration and training instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
   1. Schedule training with Owner with at least 15 days' advance notice.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

Sample ***(Modify objectives and agenda subjects for systems and equipment being covered)***

TRAINING AND ORIENTATION AGENDA

Project: _____ Date: _____

Equipment / System:_____ Spec Section(s): _____

Section 1. Audience and General Scope

Intended audience type (enter number of staff): ___facility manager, ___facility engineer, ___facility technician, ___project manager, ___tenant,
___other:_____

General objectives and scope of training: (check all that apply)

___ A. Provide an overview of the purpose and operation of this equipment, including required interactions of trainees with the equipment.

___ B. Provide technical information regarding the purpose, operation and maintenance of this equipment at an intermediate level, expecting that serious malfunctions will be addressed by factory reps.

___ C. Provide technical information regarding the purpose, operation, troubleshooting and maintenance of this equipment at a very detailed level, expecting that almost all operation, service and repair will be provided by the trainees.

Section 2. Instructors

ID	Trainer	Company	Position / Qualifications
1)	_____	_____	_____
2)	_____	_____	_____

END OF SECTION 017900

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. This Section specifies cast-in place concrete, including formwork, reinforcing, mix design, placement procedures, and finishes.

B. Cast-in-place concrete includes the following:

1. Foundations and footings.
2. Slabs-on-grade.
3. Foundation walls.
4. Slabs on metal decking.
5. **Exposed Finished Interior Slabs**
   (Provide mockup for architect and owner's approval prior to placement)

1.2 SUBMITTALS

A. General: Submit the following according to Conditions of the Contract and Division 1 Specification Sections.

B. Product data for proprietary materials and items, including reinforcement and forming accessories, pour stops, admixtures, patching compounds, waterstops, joint systems, curing compounds, dry-shake finish materials, and others if requested by Architect.

C. Shop drawings for reinforcement detailing fabricating, bending, and placing concrete reinforcement. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" showing bar schedules, stirrup spacing, bent bar diagrams, and arrangement of concrete reinforcement. Include special reinforcing required for openings through concrete structures.

D. Shop drawings for formwork indicating fabrication and erection of forms for specific finished concrete surfaces. Show form construction including jointing, special form joints or reveals, location and pattern of form tie placement, and other items that affect exposed concrete visually.

1. Architect's review is for general architectural applications and features only. Designing formwork for structural stability and efficiency is Contractor's responsibility.

E. Samples of materials as requested by Architect, including names, sources, and descriptions, as follows:

1. Color finishes.
2. Normal weight aggregates.
3. Fiber reinforcement.
4. Reglets.
5. Waterstops.
7. Form liners.

F. Laboratory test reports for concrete materials and mix design test.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

G. Material certificates in lieu of material laboratory test reports when permitted by Architect. Material certificates shall be signed by manufacturer and Contractor, certifying that each material item complies with or exceeds specified requirements. Provide certification from admixture manufacturers that chloride content complies with specification requirements.

H. Minutes of pre-installation conference.

1.3 QUALITY ASSURANCE

A. Codes and Standards: Comply with provisions of the following codes, specifications, and standards, except where more stringent requirements are shown or specified:

1. American Concrete Institute (ACI) 301, "Specifications for Structural Concrete for Buildings."
2. ACI 318, "Building Code Requirements for Reinforced Concrete."
3. Concrete Reinforcing Steel Institute (CRSI) "Manual of Standard Practice."

B. Concrete Testing Service: Engage a testing agency acceptable to Architect to perform material evaluation tests and to design concrete mixes per the requirements of chapter 17 of the IBC.

C. Materials and installed work may require testing and retesting at any time during progress of Work. Tests, including retesting of rejected materials for installed Work, shall be done at Contractor's expense.

D. Mockup: At the architects request cast mockup of size indicated or as required to demonstrate typical joints, form tie spacing, and proposed surface finish, texture, and color. Maintain sample panel exposed to view for duration of Project, after Architect's acceptance of visual qualities.

1. Demolish mockup and remove from site when directed by Architect.

E. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1. At least 7 days prior to submitting design mixes, conduct a meeting to review detailed requirements for preparing concrete design mixes and to determine procedures for satisfactory concrete operations. Review requirements for submittals, status of coordinating work, and availability of materials. Establish preliminary work progress schedule and procedures for materials inspection, testing, and certifications. Require representatives of each entity directly concerned with cast-in-place concrete to attend conference, including, but not limited to, the following:

a. Contractor's superintendent.
b. Agency responsible for concrete design mixes.
c. Agency responsible for field quality control.
d. Agency responsible for quality assurance testing.
e. Ready-mix concrete producer.
f. Concrete subcontractor.
g. Primary admixture manufacturers.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

PART 2 - PRODUCTS

2.1 FORM MATERIALS

A. Forms for Exposed Finish Concrete: Plywood, metal, metal-framed plywood faced, or other acceptable panel-type materials to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings.

1. Use overlaid plywood complying with U.S. Product Standard PS-1 "A-C or B-B High Density Overlaid Concrete Form," Class I.

2. Use plywood complying with U.S. Product Standard PS-1 "B-B (Concrete Form) Plywood," Class I, Exterior Grade or better, mill-oiled and edge-sealed, with each piece bearing legible inspection trademark.

B. Forms for Unexposed Finish Concrete: Plywood, lumber, metal, or another acceptable material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Forms for Textured Finish Concrete: Units of face design, size, arrangement, and configuration to match Architect's control sample. Provide solid backing and form supports to ensure stability of textured form liners.

D. Forms for Cylindrical Columns and Supports: Metal, glass-fiber-reinforced plastic, or paper or fiber tubes that will produce smooth surfaces without joint indications. Provide units with sufficient wall thickness to resist wet concrete loads without deformation.

G. Form Release Agent: Provide commercial formulation form release agent with a maximum of 350 g/L volatile organic compounds (VOCs) that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces. Do not allow form release agent to be applied on reinforcing steel.

H. Form Ties: Factory-fabricated, adjustable-length, removable or snap-off metal form ties designed to prevent form deflection and to prevent spalling of concrete upon removal. Provide units that will leave no metal closer than 1-1/2 inches (38 mm) to the plane of the exposed concrete surface.

1. Provide ties that, when removed, will leave holes not larger than 1 inch (25 mm) in diameter in the concrete surface.

2.2 REINFORCING MATERIALS

A. Reinforcing Bars: ASTM A 615 Grade 60 (ASTM A 615M Grade 400), deformed.

B. Steel Wire: ASTM A 82, plain, cold-drawn steel.

C. Welded Wire Fabric: ASTM A 185, welded steel wire fabric.

D. Deformed-Steel Welded Wire Fabric: ASTM A 497.

E. Supports for Reinforcement: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Use wire bar-type supports complying with CRSI specifications.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1. For slabs-on-grade, use supports with sand plates or horizontal runners where base ma rial will not support chair legs.

2. For exposed-to-view concrete surfaces where legs of supports are in contact with forms, provide supports with legs that are protected by plastic (CRSI, Class 1) or stainless steel (CRSI, Class 2).

2.3 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150, Type I, use Type II at all concrete in contact with soils.

1. Use one brand of cement throughout Project unless otherwise acceptable to Architect.

B. Fly Ash: ASTM C 618, Type F. The use of Fly Ash and/or Blast Furnace Slag is **encouraged**, except for use in interior slabs. Do not exceed 35% of cement weight.

C. Normal-Weight Aggregates: ASTM C 33 and as specified. Provide aggregates from a single source for exposed concrete.

1. For exposed exterior surfaces, do not use fine or coarse aggregates that contain substances that cause spalling.

2. Local aggregates not complying with ASTM C 33 that have been shown to produce concrete of adequate strength and durability by special tests or actual service may be used when acceptable to Architect and Engineer.

D. Water: Potable.

E. Fiber Reinforcement: Polypropylene fibrillated fibers engineered and designed for secondary reinforcement of concrete slabs, complying with ASTM C 1116, Type III, not less than 3/4 inch long.

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

2. Products: Subject to compliance with requirements, provide one of the following:

a. Gilco Fibers, Cormix Construction Chemicals.

b. Durafiber, Durafiber Corp.

c. Fiberstrand 100, Euclid Chemical Co.

d. Fibermesh, Fibermesh Co., Div. Synthetic Industries, Inc.

e. Forta, Forta Corp.

f. Grace Fibers, W.R. Grace & Co.

g. Polystrand, Metalcrete Industries

F. Admixtures, General: Provide concrete admixtures that contain not more than 0.1 percent chloride ions.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

G. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with ot required admixtures.

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

2. Products: Subject to compliance with requirements, provide one of the following:

a. Air-Tite, Cormix Construction Chemicals.

b. Air-Mix or Perma-Air, Euclid Chemical Co.

c. Darex AEA or Daravair, W.R. Grace & Co.

d. MB-VR or Micro-Air, Master Builders, Inc.

e. Sealtight AEA, W.R. Meadows, Inc.

f. Sika AER, Sika Corp.

H. Water-Reducing Admixture: ASTM C 494, Type A.

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

2. Products: Subject to compliance with requirements, provide one of the following:

a. Chemtard, ChemMasters Corp.

b. PSI N, Cormix Construction Chemicals.

c. Eucon WR-75, Euclid Chemical Co.

d. WRDA, W.R. Grace & Co.

e. Pozzolith Normal or Polyheed, Master Builders, Inc.

f. Metco W.R., Metalcrete Industries.

g. Prokrete-N, Prokrete Industries.

h. Plastocrete 161, Sika Corp.

I. High-Range Water-Reducing Admixture: ASTM C 494, Type F or Type G.

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

2. Products: Subject to compliance with requirements, provide one of the following:

a. Super P, Anti-Hydro Co., Inc.

b. Cormix 200, Cormix Construction Chemicals.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

c. Eucon 37, Euclid Chemical Co.

d. WRDA 19 or Daracem, W.R. Grace & Co.

e. Rheobuild or Polyheed, Master Builders, Inc.

f. Superslump, Metalcrete Industries.

g. PSPL, Prokrete Industries.

h. Sikament 300, Sika Corp.

J. Water-Reducing, Accelerating Admixture: ASTM C 494, Type E.

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

2. Products: Subject to compliance with requirements, provide one of the following:

a. Q-Set, Conspec Marketing & Manufacturing Co.

b. Lubricon NCA, Cormix Construction Chemicals.

c. Accelguard 80, Euclid Chemical Co.

d. Daraset, W.R. Grace & Co.

e. Pozzutec 20, Master Builders, Inc.

f. Accel-Set, Metalcrete Industries.

K. Water-Reducing, Retarding Admixture: ASTM C 494, Type D.

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

2. Products: Subject to compliance with requirements, provide one of the following:

a. PSI-R Plus, Cormix Construction Chemicals.

b. Eucon Retarder 75, Euclid Chemical Co.

c. Daratard-17, W.R. Grace & Co.

d. Pozzolith R, Master Builders, Inc.

e. Protard, Prokrete Industries.

f. Plastiment, Sika Corporation.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

2.4 RELATED MATERIALS

A. Reglets: Where sheet flashing or bituminous membranes are terminated in reglets, provide reglets of not less than 0.0217- inch- (0.46-mm-) thick galvanized sheet steel. Fill reglet or cover face opening to prevent intrusion of concrete or debris.

B. Waterstops: Provide flat, dumbbell-type or centerbulb-type waterstops at construction joints and other joints as indicated. Size to suit joints.

C. Rubber Waterstops: Corps of Engineers CRD-C 513.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

2. Manufacturers: Subject to compliance with requirements, provide products of one of the following:

a. The Burke Co.

b. Progress Unlimited.

c. Williams Products, Inc.

D. Polyvinyl Chloride Waterstops: Corps of Engineers CRD-C 572.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

2. Manufacturers: Subject to compliance with requirements, provide products of one of the following:

a. The Burke Co.

b. Greenstreak Plastic Products Co.

c. W.R. Meadows, Inc.

d. Progress Unlimited.

e. Schlegel Corp.

f. Vinylex Corp.

F. Vapor Retarder: Specified in Section 072300 - Under-Slab Vapor Retarders.

H. Nonslip Aggregate Finish: Provide fused aluminum oxide granules or crushed emery as the abrasive aggregate for a nonslip finish, with emery aggregate containing not less than 50 percent aluminum oxide and not less than 25 percent ferric oxide. Use material that is factory-graded, packaged, rustproof, nonglazing, and unaffected by freezing, moisture, and cleaning materials.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

J. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. (305 g/sq. m), complying with AASHTO M 182, Class 2.

K. Moisture-Retaining Cover: One of the following, complying with ASTM C 171.

1. Waterproof paper.

2. Polyethylene film.

3. Polyethylene-coated burlap.

L. Liquid Membrane-Forming Curing Compound: Liquid-type membrane-forming curing compound complying with ASTM C 309, Type I, Class A. Moisture loss not more than 0.55 kg/sq. m when applied at 200 sq. ft./gal (4.9 sq. m/L).

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

2. Products: Subject to compliance with requirements, provide one of the following:

a. A-H 3 Way Sealer, Anti-Hydro Co., Inc.

b. Spartan-Cote, The Burke Co.

c. Conspec #1, Conspec Marketing & Mfg. Co.

d. Sealco 309, Cormix Construction Chemicals.

e. Day-Chem Cure and Seal, Dayton Superior Corp.

f. Eucocure, Euclid Chemical Co.

g. Horn Clear Seal, A.C. Horn, Inc.

h. L&M Cure R, L&M Construction Chemicals, Inc.

i. Masterkure, Master Builders, Inc.

j. CS-309, W.R. Meadows, Inc.

k. Seal N Kure, Metalcrete Industries.

l. Kure-N-Seal, Sonneborn-Chemrex.

m. Stontop CS2, Stonhard, Inc.

M. Water-Based Acrylic Membrane Curing Compound: ASTM C 309, Type I, Class B.

1. Provide material that has a maximum volatile organic compound (VOC) rating of 350 g/L.

2. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

3. Products: Subject to compliance with requirements, provide one of the following:

    a. Highseal, Conspec Marketing and Mfg. Co.

    b. Sealco - VOC, Cormix Construction Chemicals.

    c. Safe Cure and Seal, Dayton Superior Corp.

    d. Aqua-Cure, Euclid Chemical Co.

    e. Dress & Seal WB, L&M Construction Chemicals, Inc.

    f. Masterkure 100W, Master Builders, Inc.

    g. Vocomp-20, W.R. Meadows, Inc.

    h. Metcure, Metalcrete Industries.

    i. Stontop CS1, Stonhard, Inc.

N. Evaporation Control: Monomolecular film-forming compound applied to exposed concrete slab surfaces for temporary protection from rapid moisture loss.

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

2. Products: Subject to compliance with requirements, provide one of the following:

    a. Aquafilm, Conspec Marketing and Mfg. Co.

    b. Eucobar, Euclid Chemical Co.

    c. E-Con, L&M Construction Chemicals, Inc.

    d. Confilm, Master Builders, Inc.

    e. Waterhold, Metalcrete Industries.

O. Underlayment Compound: Free-flowing, self-leveling, pumpable, cement-based compound for applications from 1 inch (25 mm) thick to feathered edges.

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

2. Products: Subject to compliance with requirements, provide one of the following:

    a. K-15, Ardex, Inc.

    b. Self-Leveling Wear Topping, W.R. Bonsal Co.

    c. Conflow, Conspec Marketing and Mfg. Co.

    d. Corlevel, Cormix Construction Chemicals.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

e. LevelLayer II, Dayton Superior Corp.

f. Flo-Top, Euclid Chemical Co.

g. Gyp-Crete, Gyp-Crete Corp.

h. Levelex, L&M Construction Chemicals, Inc.

i. Underlayment 110, Master Builders, Inc.

j. Stoncrete UL1, Stonhard, Inc.

k. Concrete Top, Symons Corp.

l. Thoro Underlayment Self-Leveling, Thoro System Products.

P. Bonding Agent: Polyvinyl acetate or acrylic base.

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

2. Products: Subject to compliance with requirements, provide one of the following:

a. Polyvinyl Acetate (Interior Only):

1) Superior Concrete Bonder, Dayton Superior Corp.

2) Euco Weld, Euclid Chemical Co.

3) Weld-Crete, Larsen Products Corp.

4) Everweld, L&M Construction Chemicals, Inc.

5) Herculox, Metalcrete Industries.

6) Ready Bond, Symons Corp.

b. Acrylic or Styrene Butadiene:

1) Acrylic Bondcrete, The Burke Co.

2) Strongbond, Conspec Marketing and Mfg. Co.

3) Day-Chem Ad Bond, Dayton Superior Corp.

4) SBR Latex, Euclid Chemical Co.

5) Daraweld C, W.R. Grace & Co.

6) Hornweld, A.C. Horn, Inc.

7) Everbond, L&M Construction Chemicals, Inc.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

8) Acryl-Set, Master Builders Inc.

9) Intralok, W.R. Meadows, Inc.

10) Acrylpave, Metalcrete Industries.

11) Sonocrete, Sonneborn-Chemrex.

12) Stonlock LB2, Stonhard, Inc.

13) Strong Bond, Symons Corp.

Q. Epoxy Adhesive: ASTM C 881, two-component material suitable for use on dry or damp surfaces. Provide material type, grade, and class to suit Project requirements.

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

2. Products: Subject to compliance with requirements, provide one of the following:

a. Burke Epoxy M.V., The Burke Co.

b. Spec-Bond 100, Conspec Marketing and Mfg. Co.

c. Resi-Bond (J-58), Dayton Superior.

d. Euco Epoxy System #452 or #620, Euclid Chemical Co.

e. Epoxtite Binder 2390, A.C. Horn, Inc.

f. Epabond, L&M Construction Chemicals, Inc.

g. Concresive Standard Liquid, Master Builders, Inc.

h. Rezi-Weld 1000, W.R. Meadows, Inc.

i. Metco Hi-Mod Epoxy, Metalcrete Industries.

j. Sikadur 32 Hi-Mod, Sika Corp.

k. Stonset LV5, Stonhard, Inc.

l. R-600 Series, Symons Corp.

2.5 PROPORTIONING AND DESIGNING MIXES

A. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301. For the trial batch method, use an independent testing agency acceptable to Architect for preparing and reporting proposed mix designs.

1. Do not use the same testing agency for field quality control testing.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

2. Limit use of fly ash and blast furnace slag to not exceed 35 percent of cement content weight.

    a. Fly ash and blast furnace slag is not permitted for interior concrete slabs.

B. Submit written reports to Architect of each proposed mix for each class of concrete at least 15 days prior to start of Work. Do not begin concrete production until proposed mix designs have been reviewed by Architect and Engineer of Record.

C. Design mixes to provide normal weight concrete with the following properties as indicated on drawings and schedules:

1. 3,000 psi, 28-day compressive strength; water-cement ratio, 0.60 maximum (non-air-entrained)

2. 4,000 psi, 28-day compressive strength; water-cement ratio, 0.5 maximum, (5% air-entrained)

3. 4,000 psi, 28-day compressive strength; water-cement ratio, 0.45 maximum (6% air-entrained), w/ Fibermesh

3. 3,500 psi, 28-day compressive strength; water-cement ratio, 050 maximum (3% air-entrained), w/ Fibermesh

D. Water-Cement Ratio: Provide concrete for following conditions with maximum water-cement (W/C) ratios as follows:

1. Subjected to freezing and thawing: W/C 0.45.

E. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows:

1. Ramps, slabs, and sloping surfaces: Not more than 3 inches (75 mm).

2. Reinforced foundation systems: Not less than 2 inch and not more than 6 inches.

3. Concrete containing high-range water-reducing admixture (superplasticizer): Not more than 8 inches (200 mm) after adding admixture to site-verified 2 - 3 inch (50 - 75 mm) slump concrete.

4. Other concrete: Not more than 4 inches (100 mm).

F. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, as accepted by Architect. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Architect before using in Work.

G. Fiber Reinforcement: Add at manufacturer's recommended rate but not less than 1.5 lb/cu. yd. (0.9 kg/cu. m).

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

2.6 ADMIXTURES

A. Use water-reducing admixture or high-range water-reducing admixture (superplasticizer) in concrete, as required, for placement and workability.

B. Use accelerating admixture in concrete slabs placed at ambient temperatures below 50 deg F (10 deg C).

C. Use high-range water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs, architectural concrete, parking structure slabs, concrete required to be watertight, and concrete with water-cement ratios below 0.50.

D. Use air-entraining admixture in exterior exposed concrete unless otherwise indicated. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having total air content with a tolerance of plus or minus 1-1/2 percent within the following limits:

1. Concrete structures and slabs exposed to freezing and thawing, deicer chemicals, or hydraulic pressure:

a. 4.0 percent (moderate exposure); 6.0 percent (severe exposure) for 3/4 inch (19 mm) maximum aggregate.

2. Other concrete not exposed to freezing, thawing, or hydraulic pressure, or to receive a surface hardener: 2 to 4 percent air.

E. Use admixtures for water reduction and set accelerating or retarding in strict compliance with manufacturer's directions.

2.7 CONCRETE MIXING

A. Ready-Mixed Concrete: Comply with requirements of ASTM C 94, and as specified.

1. When air temperature is between 85 deg F (29 deg C) and 90 deg F (32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes, and when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 GENERAL

A. Coordinate the installation of joint materials, vapor retarder/barrier, and other related materials with placement of forms and reinforcing steel and Insulated Concrete Forms

3.2 FORMS

A. General: Design, erect, support, brace, and maintain formwork to support vertical, lateral, static, and dynamic loads that might be applied until concrete structure can support such loads. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation, and position. Maintain formwork construction tolerances and surface irregularities complying with the following ACI 347 limits:

1. **Provide Class A tolerances for concrete surfaces exposed to view.**

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

2. Provide Class C tolerances for other concrete surfaces.

B. Construct forms to sizes, shapes, lines, and dimensions shown and to obtain accurate alignment, location, grades, level, and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in the Work. Use selected materials to obtain required finishes. Solidly butt joints and provide backup at joints to prevent cement paste from leaking.

C. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like for easy removal.

D. Provide temporary openings for clean-outs and inspections where interior area of formwork is inaccessible before and during concrete placement. Securely brace temporary openings and set tightly to forms to prevent losing concrete mortar. Locate temporary openings in forms at inconspicuous locations.

E. Chamfer exposed corners and edges as indicated, using wood, metal, PVC, or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.

F. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such items. Accurately place and securely support items built into forms.

G. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before placing concrete. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

3.4 PLACING REINFORCEMENT

A. General: Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars," for details and methods of reinforcement placement and supports and as specified.

1. Avoiding cutting or puncturing vapor retarder/barrier during reinforcement placement and concreting operations. Repair damages before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials that reduce or destroy bond with concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as approved by Architect.

D. Place reinforcement to maintain minimum coverages as indicated for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

E. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least (full mesh and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

3.5 JOINTS

A. Construction Joints: Locate and install construction joints so they do not impair strength or appearance of the structure, as acceptable to Architect.

B. Provide keyways at least 1-1/2 inches (38 mm) deep in construction joints in walls and slabs. Bulkheads designed and accepted for this purpose may be used for slabs.

C. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints except as indicated otherwise. Do not continue reinforcement through sides of strip placements.

D. Use bonding agent on existing concrete surfaces that will be joined with fresh concrete.

E. Waterstops: Provide waterstops in construction joints as indicated. Install waterstops to form continuous diaphragm in each joint. Support and protect exposed waterstops during progress of Work. Field-fabricate joints in waterstops according to manufacturer's printed instructions.

F. Isolation Joints in Slabs-on-Grade: Construct isolation joints in slabs-on-grade at points of contact between slabs-on-grade and vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Joint fillers and sealants are specified in Division 7 Section "Joint Sealants."

G. Contraction (Control) Joints in Slabs-on-Grade: Construct contraction joints in slabs-on-grade to form panels of patterns as shown. Use saw cuts 1/8 inch (3 mm) wide by one-fourth of slab depth or inserts 1/4 inch (6 mm) wide by one-fourth of slab depth, unless otherwise indicated.

1. Form contraction joints by inserting premolded plastic, hardboard, or fiberboard strip into fresh concrete until top surface of strip is flush with slab surface. Tool slab edges round on each side of insert. After concrete has cured, remove inserts and clean groove of loose debris.

2. Contraction joints in unexposed floor slabs may be formed by saw cuts as soon as possible after slab finishing as may be safely done without dislodging aggregate.

3. If joint pattern is not shown, provide joints not exceeding 12 ft. (4.5 m) in either direction and located to conform to bay spacing wherever possible (at column centerlines, half bays, third bays).

4. Joint fillers and sealants are specified in Division 7 Section "Joint Sealants."

3.6 INSTALLING EMBEDDED ITEMS

A. General: Set and build into formwork anchorage devices and other embedded items required for other work that is attached to or supported by cast-in-place concrete. Use setting drawings, diagrams, instructions, and directions provided by suppliers of items to be attached.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

B. Install reglets to receive top edge of foundation sheet waterproofing and to receive through-w flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, relieving angles, and other conditions.

C. Install dovetail anchor slots in concrete structures as indicated on drawings.

D. Forms for Slabs: Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and contours in finished surfaces. Provide and secure units to support screed strips using strike-off templates or compacting-type screeds.

3.7 PREPARING FORM SURFACES

A. General: Coat contact surfaces of forms with an approved, nonresidual, low-VOC, form-coating compound before placing reinforcement.

B. Do not allow excess form-coating material to accumulate in forms or come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply according to manufacturer's instructions.

1. Coat steel forms with a nonstaining, rust-preventative material. Rust-stained steel formwork is not acceptable.

3.8 CONCRETE PLACEMENT

A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other trades to permit installation of their work.

B. General: Comply with ACI 304, "Guide for Measuring, Mixing, Transporting, and Placing Concrete," and as specified.

C. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened sufficiently to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation at its final location.

D. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers no deeper than 24 inches (600 mm) and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

1. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete complying with ACI 309.

2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the machine. Place vibrators to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix to segregate.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

E. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, wi in limits of construction joints, until completing placement of a panel or section.

1. Consolidate concrete during placement operations so that concrete is thoroughly worked around reinforcement, other embedded items and into corners.

2. Bring slab surfaces to correct level with a straightedge and strike off. Use bull floats or darbies to smooth surface free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.

3. Maintain reinforcing in proper position on chairs during concrete placement.

F. Cold-Weather Placement: Comply with provisions of ACI 306 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

G. When air temperature has fallen to or is expected to fall below 40 deg F (4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.

1. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.

2. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.

H. Hot-Weather Placement: When hot weather conditions exist that would impair quality and strength of concrete, place concrete complying with ACI 305 and as specified.

1. Cool ingredients before mixing to maintain concrete temperature at time of placement to below 90 deg F (32 deg C). Mixing water may be chilled or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.

2. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedding in concrete.

3. Fog spray forms, reinforcing steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without puddles or dry areas.

4. Use water-reducing retarding admixture when required by high temperatures, low humidity, or other adverse placing conditions, as acceptable to Architect.

3.9 FINISHING FORMED SURFACES

A. Rough-Formed Finish: Provide a rough-formed finish on formed concrete surfaces not exposed to view in the finished Work or concealed by other construction. This is the concrete surface having texture imparted by form-facing material used, with tie holes and defective areas repaired and patched, and fins and other projections exceeding 1/4 inch (6 mm) in height rubbed down or chipped off.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

B. Smooth-Formed Finish: Provide a smooth-formed finish on formed concrete surfaces expo to view or to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, painting, or another similar system. This is an as-cast concrete surface obtained with selected form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch defective areas with fins and other projections completely removed and smoothed.

C. Smooth-Rubbed Finish: Provide smooth-rubbed finish on scheduled concrete surfaces that have received smooth-formed finish treatment not later than 1 day after form removal.

1. Moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.

D. Grout-Cleaned Finish: Provide grout-cleaned finish on scheduled concrete surfaces that have received smooth-formed finish treatment.

1. Combine one part portland cement to one and one-half parts fine sand by volume, and a 50:50 mixture of acrylic or styrene butadiene-based bonding admixture and water to form the consistency of thick paint. Blend standard portland cement and white portland cement in amounts determined by trial patches so that final color of dry grout will match adjacent surfaces.

2. Thoroughly wet concrete surfaces, apply grout to coat surfaces, and fill small holes. Remove excess grout by scraping and rubbing with clean burlap. Keep damp by fog spray for at least 36 hours after rubbing.

E. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike-off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.10 MONOLITHIC SLAB FINISHES

A. Scratch Finish: Apply scratch finish to monolithic slab surfaces to receive concrete floor topping or mortar setting beds for tile, portland cement terrazzo, and other bonded applied cementitious finish flooring material, and where indicated.

1. After placing slabs, finish surface to tolerances of F(F) 15 (floor flatness) and F(L) 13 (floor levelness) measured according to ASTM E 1155 (ASTM E 1155M). Slope surfaces uniformly to drains where required. After leveling, roughen surface before final set with stiff brushes, brooms, or rakes.

B. Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as specified; slab surfaces to be covered with membrane or elastic waterproofing, membrane or elastic roofing, or sand-bed terrazzo; and where indicated.

1. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating, using float blades or float shoes only, when surface water has disappeared, or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats or by hand-floating if area is small or inaccessible to power units. Finish surfaces to tolerances of

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

F(F) 18 (floor flatness) and F(L) 15 (floor levelness) measured according to ASTM E 1155 (ASTM E 1155M). Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.

C. Trowel Finish: Apply a trowel finish to monolithic slab surfaces exposed to view and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint, or another thin film-finish coating system.

1. After floating, begin first trowel-finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and finish surfaces to tolerances of F(F) 20 (floor flatness) and F(L) 17 (floor levelness) measured according to ASTM E 1155 (ASTM E 1155M). Grind smooth any surface defects that would telegraph through applied floor covering system.

D. Trowel and Fine Broom Finish: Where ceramic or quarry tile is to be installed with thin-set mortar, apply a trowel finish as specified, then immediately follow by slightly scarifying the surface with a fine broom.

E. Nonslip Broom/Grooved Finish: Apply a nonslip broom/grooved finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen concrete surface by brooming/grooveing with fiber-bristle broom perpendicular to main traffic route or groove trowel as specified by Architect. Coordinate required final finish with Architect before application.

F. Nonslip Aggregate Finish: Apply nonslip aggregate finish to concrete stair treads, platforms, ramps, sloped walks, and where indicated.

1. After completing float finishing and before starting trowel finish, uniformly spread dampened nonslip aggregate at a rate of 25 lb per 100 sq. ft. (12 kg/10 sq. m) of surface. Tamp aggregate flush with surface using a steel trowel, but do not force below surface. After broadcasting and tamping, apply trowel finishing as specified.

2. After curing, lightly work surface with a steel wire brush or an abrasive stone, and water to expose nonslip aggregate.

3.11 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place, and cure concrete as specified to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on drawings. Set anchor bolts for machines and equipment to template at correct eleva-

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

tions, complying with diagrams or templates of manufacturer furnishing machines and equipment.

D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in safety inserts and accessories as shown on drawings. Screed, tamp, and trowel-finish concrete surfaces.

3.12 CONCRETE CURING AND PROTECTION

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. In hot, dry, and windy weather protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material. Apply according to manufacturer's instructions after screeding and bull floating, but before power floating and troweling.

B. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 7 days.

C. Curing Methods: Cure concrete by curing compound, by moist curing, by moisture-retaining cover curing, or by combining these methods, as specified.

D. Provide moisture curing by the following methods:

1. Keep concrete surface continuously wet by covering with water.

2. Use continuous water-fog spray.

3. Cover concrete surface with specified absorptive cover, thoroughly saturate cover with water, and keep continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with a 4 inch (100 mm) lap over adjacent absorptive covers.

E. Provide moisture-retaining cover curing as follows:

1. Cover concrete surfaces, including exposed interior slabs, with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3 inches (75 mm) and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

F. Apply curing compound on exposed exterior slabs, walks, and curbs as follows:

1. Apply curing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours and after surface water sheen has disappeared). Apply uniformly in continuous operation by power spray or roller according to manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.

2. Use membrane curing compounds that will not affect surfaces to be covered with finish materials applied directly to concrete.

G. Curing Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces, by moist curing with forms in place for the full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

H. Curing Unformed Surfaces: Cure unformed surfaces, including slabs, floor topping, and ot flat surfaces, by applying the appropriate curing method.

1. Final cure concrete surfaces to receive finish flooring with a moisture-retaining cover, unless otherwise directed.

3.14 REMOVING FORMS

A. General: Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form-removal operations, and provided curing and protection operations are maintained.

B. Formwork supporting weight of concrete, such as beam soffits, joists, slabs, and other structural elements, may not be removed in less than 14 days or until concrete has attained at least 75 percent of design minimum compressive strength at 28 days. Determine potential compressive strength of in-place concrete by testing field-cured specimens representative of concrete location or members.

C. Form-facing material may be removed 4 days after placement only if shores and other vertical supports have been arranged to permit removal of form-facing material without loosening or disturbing shores and supports.

3.15 REUSING FORMS

A. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-coating compound as specified for new formwork.

B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use patched forms for exposed concrete surfaces except as acceptable to Architect.

3.16 CONCRETE SURFACE REPAIRS

A. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removing forms, when acceptable to Architect.

B. Mix dry-pack mortar, consisting of one part portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh (1.2 mm) sieve, using only enough water as required for handling and placing.

1. Cut out honeycombs, rock pockets, voids over 1/4 inch (6 mm) in any dimension, and holes left by tie rods and bolts down to solid concrete but in no case to a depth less than 1 inch (25 mm). Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water, and brush-coat the area to be patched with bonding agent. Place patching mortar before bonding agent has dried.

2. For surfaces exposed to view, blend white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Provide test areas at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

C. Repairing Formed Surfaces: Remove and replace concrete having defective surfaces if defe cannot be repaired to satisfaction of Architect. Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning. Flush out form tie holes and fill with dry-pack mortar or precast cement cone plugs secured in place with bonding agent.

1. Repair concealed formed surfaces, where possible, containing defects that affect the concrete's durability. If defects cannot be repaired, remove and replace the concrete.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface tolerances specified for each surface and finish. Correct low and high areas as specified. Test unformed surfaces sloped to drain for trueness of slope and smoothness by using a template having the required slope.

1. Repair finished unformed surfaces containing defects that affect the concrete's durability. Surface defects include crazing and cracks in excess of 0.01 inch (0.25 mm) wide or that penetrate to the reinforcement or completely through nonreinforced sections regardless of width, spalling, popouts, honeycombs, rock pockets, and other objectionable conditions.

2. Correct high areas in unformed surfaces by grinding after concrete has cured at least 14 days.

3. Correct low areas in unformed surfaces during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete. Proprietary underlayment compounds may be used when acceptable to Architect.

4. Repair defective areas, except random cracks and single holes not exceeding 1 inch (25 mm) in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose reinforcing steel with at least 3/4 inch (19 mm) clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

E. Repair isolated random cracks and single holes 1 inch (25 mm) or less in diameter by dry-pack method. Groove top of cracks and cut out holes to sound concrete and clean of dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding compound. Place dry-pack before bonding agent has dried. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

F. Perform structural repairs with prior approval of Architect for method and procedure, using specified epoxy adhesive and mortar.

G. Repair methods not specified above may be used, subject to acceptance of Architect.

3.17 QUALITY CONTROL TESTING DURING CONSTRUCTION

A. General: The Owner will employ a testing agency to perform tests and to submit test reports.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

B. Sampling and testing for quality control during concrete placement **may** include the followi as directed by Architect or Owners Representative.

1. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94. Provide one set of tests for each 50 cu. yd. of each type of concrete for each day's pour; provide one set of tests of the following:

   a. Slump: ASTM C 143; one test at point of discharge; additional tests when concrete consistency seems to have changed.

   b. Air Content: ASTM C 173, volumetric method for lightweight or normal weight concrete; ASTM C 231, pressure method for normal weight concrete.

   c. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F (4 deg C) and below.

   d. Compression Test Specimen: ASTM C 31; one set of four standard cylinders for each compressive-strength test, unless otherwise directed. Mold and store cylinders for laboratory-cured test specimens except when field-cured test specimens are required.

   e. Compressive-Strength Tests: ASTM C 39; one specimen tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve for later testing if required.

2. When frequency of testing will provide fewer than five strength tests for a given class of concrete, conduct testing from at least five randomly selected batches or from each batch if fewer than five are used.

3. When total quantity of a given class of concrete is less than 50 cu. yd. (38 cu. m), Architect may waive strength testing if adequate evidence of satisfactory strength is provided.

4. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.

5. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength and no individual strength test result falls below specified compressive strength by more than 500 psi (3.4 MPa).

C. Test results will be reported in writing to Architect, Structural Engineer, ready-mix producer, and Contractor within 24 hours after tests. Reports of compressive strength tests shall contain the Project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-day tests and 28-day tests.

D. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.

E. Additional Tests: The testing agency will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

the structure, as directed by Architect. Testing agency may conduct tests to determine adequa of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed.

END OF SECTION 033000

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Inspections Division
Approved with Conditions
Date: 04/11/17

SECTION 035413 - GYPSUM CEMENT UNDERLAYMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes gypsum-cement-based, self-leveling underlayment for application below interior floor coverings.

B. Related Sections include the following:
1. Division 09 Sections for patching and leveling compounds applied with finish flooring.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include manufacturer's installation instructions.

B. Shop Drawings: Include plans indicating substrates, locations, and average depths of underlayment based on survey of substrate conditions.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: Signed by gypsum cement underlayment manufacturer certifying that Installer is authorized by manufacturer to install underlayment.

B. Product Certificates: Signed by manufacturers of underlayment and floor-covering systems certifying that products are compatible.

C. Field Tests: Submit slump and field sample test reports.

D. Minutes of preinstallation conference.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Installer who is authorized in writing by manufacturer for application of underlayment products required for this Project.

B. Product Compatibility: Manufacturers of underlayment and floor-covering systems certify in writing that products are compatible.

C. Fire-Resistance Ratings: Where indicated, provide gypsum-cement underlayment systems identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

D. Sound Transmission Characteristics: Where indicated, provide gypsum-cement underlayment systems identical to those of assemblies tested for STC and IIC ratings per ASTM E 90 and ASTM E 492 by a qualified testing agency.
   1. Submit documentation that sound tests or data provided has been tested in accordance with design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

E. Preinstallation Conference: Conduct conference at Project site.
   1. Coordinate heating, ventilation and dehumidification requirements to prevent moisture related failures of completed construction that could cause mold, material failure, distortion of in-place material, or other adverse conditions affecting performance and appearance.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage, mixing with other components, and application.

B. Store materials to comply with manufacturer's written instructions to prevent deterioration from moisture or other detrimental effects. Damaged or deteriorated materials shall be removed from Project site and replaced at no additional cost to Owner.

1.7 PROJECT CONDITIONS

A. Sequencing: Do not apply gypsum cementitious underlayment until building is enclosed and weathertight, and interior partitions have been framed.

B. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature and moisture content, ventilation, ambient temperature and humidity, and other conditions affecting underlayment performance.
   1. Place gypsum-cement-based underlayments only when ambient temperature and temperature of substrates are between 50 and 80 deg F for 72 hours prior to installation and until underlayment is dry.

C. Close areas to traffic during underlayment application and for time period after application recommended in writing by manufacturer.

D. Curing: Provide continuous mechanical ventilation and heat as required by underlayment manufacturer to rapidly remove moisture from areas receiving underlayment until underlayment is dry as determined by following test.
   1. Dryness Testing: Perform test 5 to 7 days after pour. Tightly tape a 24- by 24-inch section of plastic to underlayment at rate of 1 test per 1000 square feet of floor area. If no condensation or darkening of slab occurs in 72 hours, the underlayment is considered dry and ready for sealer. Comply fully with manufacturer’s requirements.
      a. Do not use calcium chloride tests to determine moisture content.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1.8 COORDINATION

A. Coordinate application of underlayment with requirements of floor-covering products and adhesives specified in Division 09 Sections, to ensure compatibility of products.
   1. Before installing surface sealers recommended by underlayment manufacturer, verify compatibility with finish flooring installation adhesives.

PART 2 - PRODUCTS

2.1 GYPSUM-CEMENT-BASED UNDERLAYMENTS

A. Underlayment: Gypsum-cement-based, self-leveling product that can be applied in minimum uniform thickness of 1/8 inch and that can be feathered at edges to match adjacent floor elevations. Manufacturer shall comply with UL assembly.
   1. Cement Binder: Gypsum or blended gypsum cement as defined by ASTM C 219.
   2. Compressive Strength: Between 2500 (minimum) and 3200 psi at 28 days when tested according to ASTM C 472.
   3. Density: Minimum density 115 lbs/cu. ft.
   4. Installed Thickness: As indicated.
   5. Product: USG Corporation; Levelrock 2500. Provide 2500 RH at radiant heat floors.

B. Sand Aggregate: ASTM C 33, 1/8-inch or less washed masonry or plaster sand meeting requirement of underlayment manufacturer.

C. Water: Potable, free from impurities, and at a temperature of not more than 70 deg F.

D. Primer: Product of underlayment manufacturer recommended in writing for substrate, conditions, and application indicated.
   1. Product: USG Levelrock Floor Underlayment Primer.

E. Sealer: Provide sealer recommended by underlayment manufacturer for all areas that receive wood flooring, glue down resilient and carpet flooring products. In areas receiving ceramic or porcelain tile, the gypsum cement underlayment shall be protected with a waterproof membrane provided in Division 09 Section "Tile."
   1. Product: USG Levelrock SE-100 Surface Enhancer.
      a. Verify compatibility of sealer with adhesive requirements for finish flooring with flooring manufacturers.

2.2 ACCESSORIES

A. Sound Mat: ASTM E 90 and ASTM E 492 compliant, polymer resin mat with moisture control backing; sound tested by a NVLAP-accredited laboratory.
   1. Roll Size: 39.5 inches wide by 135 feet long.
   2. Thickness: 0.25 inches.
   3. Product: USG Corporation; SAM-N25 Sound Attenuation Mat.

B. Sound Mat Installation Materials:
   1. Seam Tape: Levelrock Seam Tape.
   2. Edge Strip: Levelrock Perimeter Isolation Strip.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

2.3 MIX DESIGNS

A. Mix proportions and methods shall be in strict accordance with manufacturer's written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for conditions affecting performance.
   1. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Prepare and clean substrate according to manufacturer's written instructions.
   1. Treat nonmoving substrate cracks according to manufacturer's written instructions to prevent cracks from telegraphing (reflecting) through underlayment.
   2. Fill substrate voids with a quick setting patching or caulking material, compatible with underlayment to prevent underlayment from leaking.

B. Wood Substrates: Mechanically fasten loose panels to eliminate substrate movement and squeaks. Sand to remove coatings that might impair underlayment bond and remove sanding dust.

C. Sound Control Mat: Install sound control materials according to manufacturer's written instructions. Lay mat directly over subfloor with flat, fabric side facing up. Butt edges of adjoining lengths of mat together (stagger end joints) and tape joints. Install isolation strip the thickness of the underlayment at vertical obstructions (walls) at perimeter of areas receiving gypsum cementitious underlayment
   1. Do not install mechanical fasteners that penetrate through the sound control materials.
   2. Seal the angle between perimeter isolation strip and surface of sound mat with tape recommended by sound control mat manufacturer to prevent underlayment material from flowing into spaces on underside of sound control mat.

3.3 APPLICATION OF GYPSUM CEMENTITIOUS UNDERLAYMENT

A. General: Mix and apply underlayment components according to manufacturer's written instructions.
   1. Close areas to traffic during underlayment application and for time period after application recommended in writing by manufacturer.
   2. Coordinate application of components to provide optimum underlayment-to-substrate and intercoat adhesion.

B. Subfloor Priming: Apply primer over prepared substrate (sound control mat) at manufacturer's recommended spreading rate, applying the number of coats recommended to achieve proper coverage.

C. Place gypsum cementitious underlayment over sound control mat over plywood susbflooring to thicknesses not less than those indicated for the floor assemblies. Spread and screed to produce a smooth surface. Except at joints authorized by underlayment manufacturer, place

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

underlayment in continuous application so that no product slurry is placed against product that has obtained initial set.

D. Apply underlayment to produce uniform, level surface, at proper elevation.

E. Cure underlayment according to manufacturer's written instructions. Prevent contamination during application and curing processes.

F. After underlayment has cured, trim perimeter isolation strip level with underlayment in accordance with manufacturer's instructions.

G. Sealer: Seal all areas to receive wood flooring, and for glue down floor coverings, except for areas receiving tile. In areas receiving tile, underlayment shall be protected with a waterproof membrane provided in Division 09 Section "Tile."
   1. Remove mud, oil, grease and other contaminants from surface of underlayment prior to sealing.
   2. Dilute sealer per underlayment manufacturer's written recommendations for surfaces not immediately receiving floor coverings. Apply sealer at spreading rate recommended by underlayment manufacturer's written instructions.
   3. Recoat areas where sealer has worn off due to extended trade traffic. Reapply sealer not less than 2 hours prior to application of adhesive to be used for finish flooring.

H. Do not install floor coverings over underlayment until after time period recommended in writing by underlayment manufacturer.

I. Remove and replace underlayment areas that evidence lack of bond with substrate, including areas that emit a "hollow" sound when tapped. Any floor area where the surface has been repaired shall be cleaned and sealed regardless of the type of floor covering being applied.

3.4 FIELD QUALITY CONTROL

A. Slump Test: Test underlayment for slump as it is placed for compliance with manufacturer's written recommendations. Provide test results to Architect.

B. Field Samples: Take at least three molded-cube samples from each underlayment batch. Test samples according to ASTM C 472 for compliance with compressive-strength requirements. Provide test results to Architect.

C. Testing Agency: Installer employed.

D. Test Cuts: Owner will have a separate independent testing agency verify minimum thickness compliance at rate of not less than one test cut every 3000 sq. ft. If thickness is found to be less than specified, additional cuts will be made and associated costs will be paid for by Installer. Installer shall patch all test cuts. Installer shall correct all work not in compliance with the specified requirements.

3.5 PROTECTION

A. Protect underlayment from concentrated and rolling loads with temporary wood planking for remainder of construction period.

END OF SECTION 035413

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

SECTION 039300 - CONCRETE SEALER

PART 1 – GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Concrete sealer for interior exposed slabs.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in manufacturer's original and unopened containers and labeled with type and name of products and manufacturers.

B. Comply with manufacturer's written instructions for minimum and maximum temperature requirements and other conditions for storage.

PART 2 – PRODUCTS

2.1 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment (Sealer): Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Curecrete Distribution Inc.; Ashford Formula.
      b. Dayton Superior Corporation; Day-Chem Sure Hard (J-17).
      c. Euclid Chemical Company (The), an RPM company; Euco Diamond Hard.
      d. L&M Construction Chemicals, Inc.; Seal Hard.
      e. Vexcon Chemicals, Inc.; Vexcon StarSeal PS Clear.

PART 3 – EXECUTION

3.1 PREPARATION

A. Mask walls, base, frames, mop sinks, equipment doors, frames and other surfaces that could receive sealer spatter during application.

B. Slab Preparation for Penetrating Sealer: Scrub floor with scotch brite pads and cleaning solution to remove coatings, joint compound, paint, stains, dirt, dust and other surface contaminates. Thoroughly rinse with clean potable water and dry surface, providing smooth clean surface to receive sealer.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

3.2 INSTALLATION

A. Penetrating Sealer: Prepare, apply, and finish penetrating liquid floor treatment according to penetrating sealer manufacturer's written instructions.
   1. Surface shall be dry and clean, free of dirt, dust, and stains. If surface is dirty from construction operations, clean surface with scrubbing machine and squeegee/vacuum water from surface. Surface shall be cured and dry before application.
   2. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Do not allow sealer to dry on surface. Rinse with water; remove excess material until surface is dry.

END OF SECTION 039300

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

SECTION 042000 - UNIT MASONRY ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes unit masonry assemblies consisting of the following:
   1. Face brick.
   2. Stone units.
   3. Mortar and grout.
   4. Ties and anchors.
   5. Embedded flashing.
   6. Miscellaneous masonry accessories.
   7. Masonry waste disposal.

B. Related Sections include the following:
   1. Division 06 Section "Rough Carpentry" for wood framing and wood sheathing for attachment of ties.
   2. Division 07 Section "Weather Barriers" for air/water barrier system applied over exterior sheathing to tie masonry flashing to.
   3. Division 07 Section "Joint Sealants" for sealing control and expansion joints in unit masonry.
   4. Division 0y9 Section "Exterior Gypsum Sheathing" for gypsum sheathing that is applied over exterior plywood that is covered by the weather barrier.

C. Products installed, but not furnished, under this Section include the following:
   1. Steel lintels for unit masonry, furnished under Division 05 Section "Metal Fabrications."

1.3 SUBMITTALS

A. General: Submit in accordance with Division 01 Section "Submittal Procedures."

B. Product Data: For each type of product indicated.

C. Shop Drawings: For the following:
   1. Stone Units: Show sizes, profiles, and locations of each stone base and sill unit required.
   2. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.
   3. Sill Brick: Submit sill brick shape and dimensions as determined by window opening and brick layout requirements.

D. Samples for Initial Selection: For the following:
   1. Weep holes/vents showing colors available.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this Section with minimum 5 years experience.

B. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, through one source from a single manufacturer for each product required.

C. Source Limitations for Stone Masonry: Obtain stone units through one source from a single manufacturer.

D. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from a single manufacturer for each cementitious component and from one source or producer for each aggregate.

E. Build sample panels for typical exterior wall 48 inches long by 48 inches high.
   1. Clean exposed faces of panels with masonry cleaner indicated.
   2. Approval of sample panels is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; aesthetic qualities of workmanship; and other material and construction qualities specifically approved by Architect in writing.
   3. Approval of sample panels does not constitute approval of deviations from the Contract Documents contained in sample panels unless such deviations are specifically approved by Architect in writing.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Store stone units on wood skids or pallets with nonstaining, waterproof covers. Arrange to distribute weight evenly and to prevent damage to units. Ventilate under covers to prevent condensation.

C. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

D. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.6 COORDINATION

A. Coordinate production and delivery of architectural cast stone with unit masonry work to minimize need for on-site storage and to avoid delaying Work.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1.7 PROJECT CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

B. Stain Prevention: Prevent mortar, and soil from staining the face of masonry to be left exposed. Immediately remove mortar and soil that come in contact with such masonry.
   1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
   2. Protect sills, ledges, and projections from mortar droppings.
   3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
   4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

C. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602 and the following:
   1. Cold-Weather Construction: When the ambient temperature is within the limits indicated, use the following procedures:
      a. 40 to 32 deg F: Heat mixing water or sand to produce mortar temperatures between 40 and 120 deg F.
      b. 32 to 25 deg F: Heat mixing water and sand to produce mortar temperatures between 40 and 120 deg F. Heat grout materials to produce grout temperatures between 40 and 120 deg F. Maintain mortar and grout above freezing until used in masonry.
      c. 25 to 20 deg F: Heat mixing water and sand to produce mortar temperatures between 40 and 120 deg F. Heat grout materials to produce grout temperatures between 40 and 120 deg F. Maintain mortar and grout above freezing until used in masonry. Heat masonry units to 40 deg F if grouting. Use heat on both sides of walls under construction.
      d. 20 deg F and Below: Heat mixing water and sand to produce mortar temperatures between 40 and 120 deg F. Heat grout materials to produce grout temperatures between 40 and 120 deg F. Maintain mortar and grout above freezing until used in masonry. Heat masonry units to 40 deg F. Provide enclosures and use heat on both sides of walls under construction to maintain temperatures above 32 deg F within the enclosures.
   2. Cold-Weather Protection: When the mean daily temperature is within the limits indicated, provide the following protection, this is in addition to construction procedures specified above:
      a. 40 to 25 deg F: Cover masonry insulating blankets for 48 hours after construction.
      b. 25 deg F and Below: Provide enclosure and heat to maintain temperatures above 32 deg F within the enclosure for 72 hours after construction.
   3. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

D. Hot-Weather Requirements: Protect unit masonry work when temperature and humidity conditions produce excessive evaporation of water from mortar and grout. Provide artificial shade and wind breaks and use cooled materials as required.
   1. When ambient temperature exceeds 100 deg F, or 90 deg F with a wind velocity greater than 8 mph, do not spread mortar beds more than 48 inches ahead of masonry. Set masonry units within one minute of spreading mortar.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Products: Subject to compliance with requirements, provide one of the products specified.
   2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 MASONRY UNITS, GENERAL

A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to exceed tolerances and to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not uses units where such defects, including dimensions that vary from specified dimensions by more than stated tolerances, will be exposed in the completed Work or will impair the quality of completed masonry.

2.3 BRICK

A. General: Provide shapes indicated and as follows for each form of brick required:
   1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
   2. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.
   3. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.
   4. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.
   5. Sloped Sill Brick: Custom brick shape with edge slope not less than 15 degrees. Color and texture to match face brick.

B. Face Brick: ASTM C 216, Grade SW, Type FBS.
   1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of not less than 10,000 psi.
   2. Initial Rate of Absorption: Less than 18 g/30 sq. in. per minute when tested per ASTM C 67.
   3. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

4. Size (Actual Dimensions): 3-5/8 inches wide by 2-1/4 inches high by 7-5/8 inches long, except as noted otherwise.
5. Application: Use where brick is exposed, unless otherwise indicated.
6. Products:
   a. Brick Veneer: Old Port Blend, Narrow Range; Morin Brick Co.
      1) Provide matching custom sloped sill brick.

2.4 STONE UNITS

A. Granite: ASTM C 615.
   1. Description: Medium-grained, [pink/gray/black/cream] stone..
      a. Deer Isle Granite.

B. Finish: Rock face. Sill top surface honed..

C. Provide stone units accurately shaped, with exposed faces dressed true, and with beds and joints at right angles to faces.
   1. For granite, comply with recommendations in NBGQA's "Specifications for Architectural Granite."

2.5 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

B. Hydrated Lime: ASTM C 207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement complying with ASTM C 150, Type I or Type III, and hydrated lime complying with ASTM C 207, Type S. Standard masonry cement is not acceptable. Provide one of the following portland cement-lime mix products:
   1. Eaglebond; Lafarge North America Inc.
   2. Portland and lime; Cement Quebec, Inc.
   3. Portland and lime Quikrete; The Quikrete Companies.

D. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortar.
   1. Products: Solomon Grind-Chem Services, Inc.; SGS Mortar Colors.
      a. Colors for pigmented mortar as selected by Architect from manufacturer's full range of options. Beige Range.

E. Colored Cement Product (Colored mortar option): Packaged blend made from portland cement and lime and mortar pigments, all complying with specified requirements, and containing no other ingredients.
   1. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors. Beige Range.
   2. Pigments shall not exceed 10 percent of portland cement by weight.
   3. Products:
      a. Colored Portland Cement-Lime Mix:

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1) Capital Materials Corporation; Riverton Portland Cement Lime Custom Color.
2) Holcim (US) Inc.; Rainbow Mortamix Custom Color Cement/Lime.
3) Lafarge North America Inc.; Eaglebond.
4) Lehigh Cement Company; Lehigh Custom Color Portland/Lime Cement.

F. Aggregate for Mortar: ASTM C 144.
1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.

G. Water: Potable.

2.6 TIES AND ANCHORS

A. Materials: Provide ties and anchors specified in subsequent paragraphs that are made from materials that comply with below, unless otherwise indicated.
1. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304.

B. Wire Ties, General: Unless otherwise indicated, size wire ties to extend at least halfway through veneer but with at least 5/8-inch cover on outside face. Outer ends of wires are bent 90 degrees and extend 2 inches parallel to face of veneer.

C. Stone Anchors: Fabricate dowels, cramps, and other stone anchors from stainless steel.

D. Adjustable Masonry-Veneer Anchors:
1. General: Provide anchors that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing to wood or metal studs, and as follows:
a. Structural Performance Characteristics: Capable of withstanding a 100-lbf load in both tension and compression without deforming or developing play in excess of 0.05 inch.
b. Fabricate sheet metal anchor sections and other sheet metal parts from 0.078-inch-thick, stainless steel sheet.
2. Screw-Attached, Masonry-Veneer Anchors with Weather-Resistant Gypsum Sheathing: Units consisting of a wire tie and an adjustable metal anchor section.
a. Anchor Section: Dual diameter barrel section with and metal backed EPDM washer, and corrosion-resistant, self-drilling screw. ASTM C954, 1000 hour polymer coating. Eye designed to receive wire tie and to serve as head for drilling fastener into framing. Barrel length to suit sheathing and insulation thickness, allowing screw to seat directly against framing with flanged head covering hole in insulation.
b. Wire Ties: Triangular-shaped wire ties fabricated from 0.188-inch- diameter, adjustable, stainless steel wire.
c. Product: Hohmann & Barnard; 2-Seal Tie.

2.7 EMBEDDED FLASHING MATERIALS

A. Metal Flashing: Provide metal flashing, where flashing is exposed or partly exposed and where indicated, complying with SMACNA's "Architectural Sheet Metal Manual, Division 07 Section "Sheet Metal Flashing and Trim," and as follows:

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1. Copper: ASTM B 370, Temper H00 or H01, cold-rolled copper sheet, 16-oz./sq. ft. weight or 0.0216 inch thick.
2. Fabrication: Form metal flashing to required shape using sheet metal break. Solder corners of pan type flashing.
    a. Fabricate metal flashing with drip edge. Fabricate by extending flashing 3/8 inch out from wall, with outer edge bent down 45 degrees.
    b. Lintel head flashings shall be fabricated with ends turned up and inside corners soldered. Metal flashing shall extend horizontally across lintel angle, up the vertical leg, and across the cavity. and 4 inches up the face of wall to tie-in to the air weather barrier.

B. Flashing Tapes for Sealing Top of Metal Flashing to Weather Barrier: Pressure-sensitive, self-adhering, cold-applied, proprietary seam tape. Seam tape shall be from same manufacturer as weather barrier. Butyl flashing tapes are not acceptable.
1. VaproShield LLC, VaproFlashing SA flashing tape shall be used in conjunction with the WrapShield SA weather barrier system, no substitution.
2. Fluid Applied Flashing Sealant: VaproShield LLC; VaproLiqui-Flash liquid-applied flashing and joint sealant.
    a. Use for sealing across top edge and ends of flashing tape.
3. Local VaproShield Representative: Bob McEachern, Roof Tech Sales LLC; phone: (603) 494-3757.

2.8 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene, urethane, or PVC.

B. Weep/Vent Products: Use the following, unless otherwise indicated:
1. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch less than depth of outer wythe, in color selected from manufacturer's standard.
    a. Products:
        1) Hohmann & Barnard, Inc.; Quadro-Vent.
        2) Wire-Bond; Cell Vent.

C. Cavity Drainage Material: Free-draining mesh, made from nonabsorbent, polymer strands that will not degrade within the wall cavity.
1. Configuration: Strips, full-depth of cavity and 10 inches wide, with dovetail shaped notches 7 inches deep that prevent mesh from being clogged with mortar droppings.
2. Thickness: 1-inch.
3. Product: Mortar Net; Mortar Net USA, Ltd.

2.9 MASONRY CLEANERS

A. Proprietary Buffered Detergent-Based Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry and precast concrete surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned. Muriatic acid is not permitted.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1. Cleaners for Brick:
   a. EaCoChem; NMD 80.

2.10 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
   1. Do not use calcium chloride in mortar.
   2. Limit cementitious materials in mortar for masonry to portland cement and lime.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonryand Stone: Comply with BIA Technical Notes 8A, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.
   1. For exterior veneer masonry below grade or in contact with earth, use Type M.
   2. For exterior veneer masonry, use Type N.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
   1. If unsatisfactory conditions are encountered, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
   2. Verify that foundations are within tolerances specified.

B. Before installation, examine rough-in and built-in construction for piping and electrical systems to verify actual locations of piping and conduit connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying. Install cut units with cut surfaces and, where possible, cut edges concealed.

B. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.
   1. Mix units from several pallets or cubes as they are placed.

C. Comply with construction tolerances in ACI 530.1/ASCE 6/TMS 602 and with the following:

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
2. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
3. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
4. For exposed bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch. Do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
5. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.
6. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.

3.3 STONE VENEER AND TRIM INSTALLATION, GENERAL

A. Sort stone before it is placed in wall to remove stone that does not comply with requirements relating to aesthetic effects, physical properties, or fabrication, or that is otherwise unsuitable for intended use.

B. Set stone to comply with requirements indicated on Drawings and approved Shop Drawings. Install veneer anchors, supports, fasteners, and other attachments necessary to permanently secure stone veneer assemblies in place. Set stone accurately in locations indicated with edges and faces aligned according to established relationships and indicated tolerances.

C. Maintain uniform joint widths of not less than 3/8 inch nor more than 1/2 inch.

D. Install embedded flashing and weep holes where indicated.

3.4 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in bond pattern as follows; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.
   1. Brick Veneer: Shall have running bond. Provide soldier courses, where indicated. Coordinate locations with building elevations.

C. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar before laying fresh masonry.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

D. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

3.5 MORTAR BEDDING AND JOINTING

A. Lay brick veneer units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
   1. Full head joints in masonry veneer is required to make wall as water impermeable as possible. If field observations finds head joints are not fully filled, the contractor will be required to remove brick at random locations as directed by the Architect. If additional locations are found with partially filled head joints, the masonry veneer shall be removed and new masonry veneer properly laid.

B. Set stone trim units and stone veneer pieces in full bed of mortar with full vertical joints. Fill dowel, anchor, and similar holes solid.
   1. Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.
   2. Allow cleaned surfaces to dry before setting.

C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.

3.6 CAVITY WALLS

A. Keep cavities clean of mortar droppings and other materials during construction. Strike joints facing cavities flush.
   1. Use wood strips temporarily placed in cavity to collect mortar droppings. As work progresses, remove strips, clean off mortar droppings, and replace in cavity.
   2. Place cavity drainage mat at the base flashing of all new masonry, providing a continuous drainage system at base of wall, at heads of windows, doors, and other horizontal interruptions in cavity. (Note: It is still intended to have mortar dropping minimized through proper placement, drag boards and other methods required to keep the cavity clear.)

B. At base of cavity wall where brick runs below grade, fill cavity solid with mortar, without voids up to an elevation above grade. Smooth top of mortar in cavity to provide a level uniform surface to receive flashing.

3.7 ANCHORING MASONRY VENEERS

A. Anchor masonry veneers to wall framing, with masonry-veneer anchors to comply with the following requirements:
   1. Fasten anchors through weather barrier and gypsum sheathing to wall framing . . Fasteners shall penetrate through plywood into studs 1-1/4 inches minimum.
   2. Embed tie sections in masonry joints. Provide not less than 1-1/2 inches of air space between back of masonry veneer and face of gypsum sheathing.
   3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

4. Space anchors as indicated, but not more than 16 inches o.c. vertically and 16 inches o.c. horizontally, with not less than 1 anchor for each 1.77 sq. ft. of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 8 inches, around perimeter.
5. Provide anchors in each joint of stone masonry veneer piece as indicated on shop drawings.

3.8 CONTROL AND EXPANSION JOINTS

A. General: Install control and expansion joint materials in veneer masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
1. Where control joints are not shown, provide control joints at a maximum spacing of 30 feet; review proposed locations with Architect prior to installation.

B. Form expansion joints in brick and stone as follows:
1. Form open joint full depth of brick wythe and of width indicated, but not less than 3/8 inch for installation of sealant and backer rod specified in Division 07 Section "Joint Sealants."

3.9 LINTELS

A. Install steel lintels of sizes indicated.

B. Provide minimum bearing of 8 inches at each jamb, unless otherwise indicated.

3.10 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS

A. General: Install embedded flashing and weep holes in masonry at wall base, shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. Install vents at top of wall, and other obstructions to permit upward flow of air in cavities, and where indicated.

B. Install flashing as follows, unless otherwise indicated:
1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as specified.
2. Extend sheet metal flashing 3/8 inch beyond face of masonry at exterior and turn flashing down at 45 degrees to form a drip. Lap joints of metal flashing 3 inches, sealing between horizontal and vertical legs with full bed of asphalt mastic. Over the top of each joint, apply a 4-inch wide strip of rubberized asphalt sheet flashing to both horizontal and vertical legs.
   a. At base of walls, run metal flashing vertical face up wall 8 inches minimum.
   b. At lintel angles, run metal flashing vertical face up wall 6 inches minimum.
3. At lintels, extend flashing a minimum of 8 inches into masonry at each end, turning up not less than 2 inches to form end dams with inside corners soldered.
4. Metal flashing shall be one piece, full width of opening. Where opening width exceeds available sheet metal length, lap joints of metal flashing 3 inches, sealing between with full bed of asphalt mastic. Over the top of each joint, apply a 6-inch wide strip of rubberized asphalt sheet flashing to both the horizontal and vertical legs.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

5. At the top of metal flashings, nail through weather barrier and gypsum sheathing to wood sheathing at 8 inches on center with copper or stainless steel nails, drawing flashing in tight contact with sheathing, Locate nails near top edge so they are covered with flashing tape. Coordinate installation of flashing with installer of the weather/air barrier. Along top of flashing, apply a continuous strip of flashing tape, lapping onto sheathing weather barrier 6 inches minimum and over top of flashing and nails 3 inches. Roll surface of flashing tape with hard rubber roller to assure proper adhesion. Apply continuous bead of liquid applied flashing sealant across top of tape and trowel smooth. Initial flashing installation and periodic checks with the weather barrier tie in shall be inspected and approved by the weather barrier manufacturer's designated representative before hidden by the masonry veneer.

C. Install weep holes in head joints in exterior wythes of first course of masonry immediately above embedded flashing at base of walls and above lintels and as follows:
   1. Use specified weep/vent products to form weep holes.
   2. Space weep holes 24 inches o.c., unless otherwise indicated.
   3. Provide weep holes not more than 8 inches from end of lintels.

D. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in Part 2 "Miscellaneous Masonry Accessories" Article.

E. Install vents in head joints in exterior wythes at tops of walls at spacing indicated; if spacing not indicated, space vents a maximum of 48 inches o.c. Use specified weep/vent products to form vents.

3.11 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Protect building elements, plants and surrounding areas that could be damaged from exposure to masonry detergent.

E. Surface and air temperature for cleaning shall be not less than 40 degrees F, and shall remain above 40 degrees F for 48 hours after completion of cleaning.

F. Final Cleaning – New Brick: After mortar is thoroughly set and cured, clean exposed masonry as follows:
   1. Allow mortar to cure above 45 degrees F or greater for minimum 14 days before cleaning. If cure temperature is below 45 degrees F, allow additional time above 45 degrees F to achieve the 14 day cure period to allow the mortar to cure thoroughly.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

2. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
3. Mix cleaner with water at manufacturer's recommended rate. Test cleaning methods on wall at an inconspicuous location.
4. Protect adjacent non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
5. Lightly pre-wet wall surfaces with water before applying cleaner.
6. Clean brick in accordance with manufacturer's printed instructions:
   a. Apply cleaner with low-pressure sprayer and allow to foam and dwell until foam collapses. Reapply cleaner without rinsing until cleaner no longer foams. Do not let cleaner dry on surface.
   b. Pressure wash surface using 25 to 40 degree wide tip nozzle. Use the minimum pressure possible, as determined by the sample test area. Rinse in overlapping pattern, maintaining tip location and pressure in a manner to prevent surface damage to masonry units and mortar joints.
7. Clean stone sills and veneer to comply with stone supplier's written instructions.

G. Protection: Provide final protection and maintain conditions that ensure unit masonry is without damage and deterioration at time of Substantial Completion.

3.12 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

B. Excess Masonry Waste: Remove excess clean masonry waste and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042000

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

SECTION 051200 - STRUCTURAL STEEL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Structural steel.
2. Architecturally exposed structural steel.
3. Grout.

B. Related Sections include the following:

1. Division 1 Section "Quality Requirements" for independent testing agency procedures and administrative requirements.
2. Division 5 Section "Metal Fabrications" for steel lintels not attached to structural-steel frame and other metal items not defined as structural steel.
3. Division 9 painting Sections for surface preparation and priming requirements.

1.3 DEFINITIONS

A. Structural Steel: Elements of structural-steel frame, as classified by AISC's "Code of Standard Practice for Steel Buildings and Bridges," that support design loads.

B. Architecturally Exposed Structural Steel: **All exposed structural steel shall be treated as if designated as architecturally exposed structural steel.**

1.4 QUALITY ASSURANCE:

A. Fabricator Qualifications: Experienced in fabrication of structural steel for projects of similar size and difficulty. Subject to approval of Architect, Engineer and Owner.

B. Welder Qualifications:

1. Welding shall be done only by welding operators currently qualified according to AWS D1.1.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

C. Testing Agency:

1. Testing and inspection will be made by an approved testing laboratory selected and paid by the Owner. Contractor shall furnish testing agency access to work, facilities, and incidental labor required for testing and inspection. Retention by the Owner of an independent testing agency shall in no way relieve the Contractor of responsibility for performing all work in accordance with the contract requirements.

2. Furnish the testing agency with the following:

   a. A complete set of Shop and Erection Drawings.
   b. Information as to time and place of all rollings and shipment of material to shops.
   c. Full and ample means and assistance for testing all materials.
   d. Proper facilities, including scaffolding, temporary work platforms, etc., for inspection of the work in the mills, shop and field.
   e. Representative sample pieces requested for testing.
   f. Each person installing connections shall be assigned an identifying symbol or mark, and all shop and field connection shall be identified so that the inspector can refer back to the person making the connection.

D. Reference Standards:

1. Design, Detailing, Fabrication and Erection: Meet requirements of AISC Specification for the Design, Fabrication and Erection of Structural Steel for Buildings, and AISC Code of Standard Practice, latest editions including supplements.
2. Welding: Meet requirements of AWS Structural Welding Code D1.1, latest edition.
3. High Strength Bolts: Meet requirements of AISC Specifications for Structural Joints Using ASTM A325 or A490 Bolts, latest edition.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show fabrication of structural-steel components.

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
2. Include embedment drawings.
3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.
5. For structural-steel connections indicated to comply with design loads, include structural analysis data prepared by the qualified professional engineer responsible for their preparation.

C. Welding certificates.

D. Qualification Data: For Installer, fabricator and testing agency.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

E. Mill Test Reports: Signed by manufacturers certifying that the following products comply w requirements:

1. Structural steel including chemical and physical properties.
2. Bolts, nuts, and washers including mechanical properties and chemical analysis.
3. Tension-control, high-strength bolt-nut-washer assemblies.
4. Shop primers.
5. Nonshrink grout.

F. Source quality-control test reports.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector.

B. Fabricator Qualifications: A qualified fabricator who participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant.

C. Shop-Painting Applicators: Qualified according to AISC's SSPC-QP 3, "Standard Procedure for Evaluating Qualifications of Shop Painting Applicators."

D. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."

E. Comply with applicable provisions of the following specifications and documents:

1. AISC's "Code of Standard Practice for Steel Buildings and Bridges."
2. AISC's "Seismic Provisions for Structural Steel Buildings" and "Supplement No. 2."
3. AISC's "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design"
4. AISC's "Specification for the Design of Steel Hollow Structural Sections."
5. AISC's "Specification for Allowable Stress Design of Single-Angle Members "
6. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

F. Mockups: Build mockups of architecturally exposed structural steel and typical connection to set quality standards for fabrication and installation.

1. Coordinate finish painting requirements with Division 9 painting Sections.
2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from erosion and deterioration.

1. Store fasteners in a protected place. Clean and relubricate bolts and nuts that become dry or rusty before use.
2. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.8 COORDINATION

A. Furnish anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: ASTM A 992, Grade 50

B. Channels, Angles: ASTM A 36

C. Plate and Bar: ASTM A 36

D. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B, structural tubing.

E. Pipe: ASTM A 53, Gr B

F. Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts, Nuts, and Washers: ASTM A325 and A490, Type 1, heavy hex steel structural bolts or tension-control, (ASTM F1852) bolt-nut-washer assemblies with splined ends; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.

1. Finish: Plain or Hot-dip zinc coating, ASTM A 153/A 153M, Class C, per drawings

B. Threaded Rods: ASTM A 36/A 36M or ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6).

1. Nuts: ASTM A 563 (ASTM A 563M) hex carbon steel.
2. Washers: ASTM A 36/A 36M carbon steel.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

3. Finish: Plain or Hot-dip zinc coating per plans

C. Sleeve Nuts: ASTM A 108, Grade 1018, cold-finished carbon steel.

2.3 PRIMER

A. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer, UNO by Architect, etc.

B. Galvanizing Repair Paint: MPI#18, MPI#19, or SSPC-Paint 20.

2.4 GROUT

A. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404, Size No. 2. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

B. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.5 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges"
   1. Mark and match-mark materials for field assembly.
   2. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. Architecturally Exposed Structural Steel: Comply with fabrication requirements, including tolerance limits, of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for structural steel exposed to view.

   1. Fabricate with exposed surfaces smooth, square, and free of surface blemishes including pitting, rust, scale, roughness and welding or cutting slag.
   2. Remove blemishes by filling or grinding or by welding and grinding, before cleaning, treating, and shop priming.

C. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.

   1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.

D. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.

E. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

F. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 1, "Solvent Cleaning"

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

G. Steel Wall-Opening Framing: Select true and straight members for fabricating steel wi opening framing to be attached to structural steel. Straighten as required to provide uniform, square, and true members in completed wall framing.

H. Welded Door Frames: Build up welded door frames attached to structural steel. Weld exposed joints continuously and grind smooth. Plug-weld fixed steel bar stops to frames. Secure removable stops to frames with countersunk, cross-recessed head machine screws, uniformly spaced not more than 10 inches (250 mm) o.c., unless otherwise indicated.

I. Holes: Provide holes required for securing other work to structural steel and for passage of other work through steel framing members.

1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning w/out the approval of the Engineer.
2. Base-Plate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.6 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.

1. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.
3. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent weld show-through on exposed steel surfaces.
   a. Grind butt welds flush.
   b. Grind or fill exposed fillet welds to smooth profile. Dress exposed welds.

2.7 SHOP PRIMING

A. Shop prime steel surfaces except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
2. Surfaces to be field welded.
3. Surfaces to be high-strength bolted with slip-critical connections.
4. Surfaces to receive sprayed fire-resistive materials.
5. Galvanized surfaces.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale a spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:

1. SSPC-SP 2, "Hand Tool Cleaning."
2. SSPC-SP 3, "Power Tool Cleaning."

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a dry film thickness of not less than 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
2. Apply two coats of shop paint to inaccessible surfaces after assembly or erection. Change color of second coat to distinguish it from first.

D. Painting: Apply a 1-coat, nonasphaltic primer complying with SSPC-PS Guide 7.00, "Painting System Guide 7.00: Guide for Selecting One-Coat Shop Painting Systems," to provide a dry film thickness of not less than 1.5 mils (0.038 mm).

2.8 SOURCE QUALITY CONTROL

A. Owner will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.

1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.

B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

C. Bolted Connections: Shop-bolted connections will be inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

D. Welded Connections: In addition to visual inspection, shop-welded connections may be tested and inspected according to AWS D1.1 and the following inspection procedures, at testing agency's option:

1. Liquid Penetrant Inspection: ASTM E 165.
2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
3. Ultrasonic Inspection: ASTM E 164.
4. Radiographic Inspection: ASTM E 94.

E. In addition to visual inspection, shop-welded shear connectors will be tested and inspected according to requirements in AWS D1.1 for stud welding and as follows:

1. Bend tests will be performed if visual inspections reveal either a less-than- continuous 360-degree flash or welding repairs to any shear connector.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

2. Tests will be conducted on additional shear connectors if weld fracture occurs on sh connectors already tested, according to requirements in AWS D1.1.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments, with steel erector present, for compliance with requirements.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place, unless otherwise indicated.

1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC's "Code of Standard Practice for Steel Buildings and Bridges"

B. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting base and bearing plates. Clean bottom surface of base and bearing plates.

1. Set base and bearing plates for structural members on wedges, shims, or setting nuts as required.
2. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of base or bearing plate before packing with grout.
3. Promptly pack grout solidly between bearing surfaces and base or bearing plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

C. Maintain erection tolerances of structural steel and architecturally exposed structural steel] within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

D. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

in permanent contact with members. Perform necessary adjustments to compensate discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.
2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

E. Splice members only where indicated.

F. Remove erection bolts on welded, architecturally exposed structural steel; fill holes with plug welds; and grind smooth at exposed surfaces.

G. Do not use thermal cutting during erection unless approved by Architect. Finish thermally cut sections within smoothness limits in AWS D1.1.

H. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

I. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.

1. Comply with AISC's "Code of Standard Practice for Steel Buildings and Bridges" for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
3. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.
4. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent weld show-through on exposed steel surfaces.

    a. Grind butt welds flush.
    b. Grind or fill exposed fillet welds to smooth profile. Dress exposed welds.

C. Architecturally Exposed Structural Steel: Comply with erection requirements, including tolerance limits, of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for structural steel exposed to view.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1. Install with exposed surfaces smooth, square, and free of surface blemishes includ pitting, rust, scale, roughness and welding or cutting slag.
2. Remove blemishes by filling or grinding or by welding and grinding, before cleaning, treating, and shop priming.

3. Clean all weld to free from slag with a chipping hammer and wire brush. Prime all field welds. Unslightly welds shall be ground smooth and filled as needed to comply with the standards set with the approved Mochups.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.

B. Bolted Connections: Shop-bolted connections will be inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

C. Welded Connections: Field welds will be visually inspected according to AWS D1.1.

1. In addition to visual inspection, field welds may be tested according to AWS D1.1 and the following inspection procedures, at testing agency's option:

    a. Liquid Penetrant Inspection: ASTM E 165.
    b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
    c. Ultrasonic Inspection: ASTM E 164.
    d. Radiographic Inspection: ASTM E 94.

D. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1 for stud welding and as follows:

1. Perform bend tests if visual inspections reveal either a less-than- continuous 360-degree flash or welding repairs to any shear connector.
2. Conduct tests on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1.

E. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.6 REPAIRS AND PROTECTION

A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists and accessories, bearing plates, and abutting structural steel.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-t cleaning.
2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.

C. Touchup Painting: Cleaning and touchup painting are specified in Division 9 painting Sections.

END OF SECTION 05 12 00

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes, but is not limited to, the following:
1. Elevator pit ladder.
2. Alternating tread ship's ladder.
3. Steel pipe handrails.
4. Loose steel lintels.
5. √Steel framing and supports for the following:
a. Elevator hoist beams.
b. Elevator door subsills.
c. Steel framing and supports for applications where framing and supports are not specified in other Sections.
6. Steel weld plates and angles for casting into concrete not specified in other Sections.
7. Miscellaneous fabrications:
a. Sump pit cover and support.
8. Metal bollards.
9. Rough hardware.
10. Spiral stairs.

B. Products furnished, but not installed, under this Section include the following:
1. Loose steel lintels.
2. Anchor bolts, indicated to be cast into concrete.

C. Related Sections include the following:
1. Division 03 Section "Cast-in-Place Concrete" for installing anchor bolts and other items indicated to be cast into concrete.
2. Division 04 Section "Unit Masonry Assemblies" for installing loose lintels built into masonry.
3. Division 05 Section "Structural Steel."
4. Division 06 Section "Rough Carpentry" for concealed wood blocking for anchoring railings attached to walls and for metal framing anchors.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance of Railings: Provide railings capable of withstanding the effects of gravity loads, IBC 2009 requirements, and the following loads and stresses within limits and under conditions indicated:
1. Handrails:
a. Uniform load of 50 lbf/ ft. applied in any direction.
b. Concentrated load of 200 lbf applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

B. Structural Performance of Ladders: Provide ladders capable of withstanding the effects of loads and stresses within limits and under conditions specified in ANSI A14.3, except as indicated otherwise.
   1. Elevator Pit Ladders: Comply with ASME A17.1.

C. Thermal Movements: Provide exterior metal fabrications that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

1.4 SUBMITTALS

A. General: Submit in accordance with Division 01 Section "Submittal Procedures."

B. Product Data: For the following:
   1. Grout.

C. Shop Drawings: Show fabrication and installation details for stairs, railings, infill system, guardrails and metal fabrications.
   1. Include plans, elevations, sections, and details of railings and metal fabrications and their connections. Show anchorage and accessory items.
   2. Provide templates for anchors and bolts specified for installation under other Sections.
   3. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional structural engineer responsible for their preparation.

D. Calculations for Metal Fabrications, Railings: Designed and engineered by a qualified professional structural engineer responsible for their preparation. Submittal shall be signed and stamped by engineer.

E. Welding Certificates: Signed by Contractor certifying that welders comply with requirements specified under the "Quality Assurance" Article.

F. Qualification Data: For professional structural engineer.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Firm experienced in producing metal fabrications similar to those indicated for this Project with a record of successful in-service performance, and with sufficient production capacity to produce required units without delaying the Work.

B. Welding: Qualify procedures and personnel according to the following:
   1. AWS D1.1, "Structural Welding Code--Steel."
   2. AWS D1.3, "Structural Welding Code--Sheet Steel."
   3. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone re-certification.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication and indicate measurements on Shop Drawings.
   1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
   2. Provide allowance for trimming and fitting at site.

1.7 COORDINATION

A. Coordinate installation of anchorages for metal fabrications and metal stairs. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

B. Coordinate installation of steel weld plates and angles for casting into concrete or built into unit masonry that are specified in this Section but required for work of another Section. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.2 FERROUS METALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
   1. Galvanized finish for exterior installations and where indicated.

B. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.

C. Steel Tubing: Product type (manufacturing method) and as follows:
   1. Cold-Formed Steel Tubing: ASTM A 500.
   2. Hot-Formed Steel Tubing: ASTM A 501.
      a. For exterior installations and where indicated, provide tubing with hot-dip galvanized coating per ASTM A 53.

D. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.
   1. Black finish, unless otherwise indicated.
   2. Galvanized finish for exterior installations and where indicated.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

2.3 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.

C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless steel bolts, nuts and, where indicated, flat washers; ASTM F 593 for bolts and ASTM F 594 for nuts, Alloy Group 1.

D. Anchor Bolts: ASTM F 1554, Grade 36.
   1. Provide hot-dip or mechanically deposited, zinc-coated anchor bolts where item being fastened is indicated to be galvanized.

E. Eyebolts: ASTM A 489.

F. Machine Screws: ASME B18.6.3.

G. Lag Bolts: ASME B18.2.1.

H. Wood Screws: Flat head, ASME B18.6.1.

I. Plain Washers: Round, ASME B18.22.1.

J. Lock Washers: Helical, spring type, ASME B18.21.1.

K. Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
   1. Material for Anchors in Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.
   2. Material for Anchors in Exterior Locations: Alloy Group 1 stainless-steel bolts complying with ASTM F 593 and nuts complying with ASTM F 594.

L. Toggle Bolts: FS FF-B-588, tumble-wing type, class and style as required.

M. Chemical Anchors: Two-part epoxy systems with impacted bolt, rod or anchor as follows:
   1. Concrete Anchor: Epoxy capsule system similar to Hilti HVA Adhesive Anchor System, Ramset Chemset anchor system, or approved equal.
   2. Masonry Anchor: Epoxy injection system similar to Hilti HIT C-100 System.

2.4 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with performance requirements of FS TT-P-664, selected for good resistance to

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

normal atmospheric corrosion, compatibility with finish paint system indicated, and capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.

C. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

E. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
   1. Products:
      a. Sure-grip High Performance Grout; Dayton Superior Corp.
      b. Euco N-S Grout; Euclid Chemical Co.
      c. Five Star Grout; Five Star Products.
      d. Crystex; L & M Construction Chemicals, Inc.
      e. Masterflow 928 and 713; Master Builders Technologies, Inc.
      f. Sealtight 588 Grout; W. R. Meadows, Inc.
      g. Sonogrout 14; Sonneborn Building Products - ChemRex, Inc.

F. Concrete Materials and Properties: Comply with requirements in Division 03 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi, unless otherwise indicated.

2.5 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Form metal fabrications from materials of size, thickness, and shapes indicated but not less than needed to comply with performance requirements indicated. Work to dimensions indicated or accepted on Shop Drawings, using proven details of fabrication and support. Use type of materials indicated or specified for various components of each metal fabrication.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

E. Form exposed work true to line and level with accurate angles and surfaces and straight edges.

F. Weld corners and seams continuously to comply with the following:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts, unless otherwise indicated. Locate joints where least conspicuous.

H. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

I. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

J. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

2.6 METAL LADDERS

A. General:
1. Comply with ANSI A14.3, unless otherwise indicated.
   a. For elevator pit ladders, comply with ASME A17.1.
2. Space siderails 18 inches apart for elevator pit ladders and 24 inches apart for other ladders, unless otherwise indicated.
3. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted brackets, made from same metal as ladder.
   a. Size brackets to support design dead and live loads indicated and to hold centerline of ladder rungs clear of the wall surface by not less than 7 inches, except as otherwise indicated.
      1) For elevator pit ladders, hold centerline of ladder rungs clear of the wall surface by not less than 5 inches.
   b. Extend siderails 48 inches above top rung and return rails to wall or structure unless other secure handholds are provided. If the adjacent structure does not extend above the top rung, gooseneck the extended rails back to the structure to provide secure ladder access.

B. Steel Ladders:
1. Siderails: Continuous, 3/8-by-2-1/2-inch steel flat bars, with eased edges, spaced 18 inches apart.
2. Rungs: 1-inch- diameter steel bars, spaced 12 inches o.c.
3. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
4. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.

2.7 PREMANUFACTURED SHIP'S LADDER

A. Acceptable Manufacturer: Alternating steel stair by Lapeyre Stair, Inc. meeting OSHA and IBC codes.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

B. Dimensions: 68 degree stair angle.

C. Materials: Carbon steel meeting ASTM A 569.
1. Treads: 13 gage.
2. Landings and Foot Stampings: 11 gage.
3. Stringers: 3 inch by 1-3/4 inch by 11 gage.
4. Handrails: 1-1/2 inch OD by 0.083 inch.

D. Miscellaneous Materials:
1. Rubber Spine: Hollow neoprene.
2. Rubber Foot Divider: Solid neoprene.

E. Finish: Powder coat, color selected by Architect.

2.8 STEEL PIPE HANDRAILS

A. General: Fabricate steel pipe handrails to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of tube, spacings, and anchorage, but not less than that needed to withstand indicated loads.
1. Configuration: 1-1/4-inch- diameter pipe handrails mounted as indicated.

B. Welded Connections: Fabricate railings with welded connections. Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings. All exposed welds shall be ground smooth.

C. Form changes in direction of railings by use of prefabricated elbow fittings and radius bends.

D. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

E. Close exposed ends of railing members by welding 3/16-inch thick steel plate in place or by use of prefabricated fittings.

F. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated.

G. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work. Furnish inserts and other anchorage devices for connecting to concrete or masonry work.
1. Wall Brackets for Pipe Handrails: Julius Blum No. 306, cast malleable iron.

H. Fillers: Provide fillers made from steel plate, or other suitably crush-resistant material, where needed to transfer wall bracket loads through wall finishes to structural supports. Size fillers to suit wall finish thicknesses and to produce adequate bearing area to prevent bracket rotation and overstressing of substrate.

I. Apply shop primer to uncoated surfaces of metal railing components. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

2.9 LOOSE STEEL LINTELS

A. Fabricate loose structural steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated.

B. Weld adjoining members together to form a single unit where indicated.

C. Size loose lintels for equal bearing of 1-inch per foot of clear span but not less than 8-inches bearing at each side of openings, unless otherwise indicated.

D. Galvanize loose steel lintels located in exterior walls.

2.10 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports for applications indicated that are not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.
   1. Equip units with integrally welded anchors for casting into concrete or building into masonry. Furnish inserts if units must be installed after concrete is placed.
      a. Except as otherwise indicated, space anchors 24 inches o.c. and provide minimum anchor units in the form of steel straps 1-1/4 inches wide by 1/4 inch thick by 8 inches long.
   2. Furnish inserts if units are installed after concrete is placed.

C. Galvanize miscellaneous framing and supports at exterior locations and where indicated.

2.11 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with not less than two integrally welded steel strap anchors for embedding in concrete.

2.12 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
   1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

C. Galvanize exterior miscellaneous steel trim.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

2.13 METAL BOLLARDS

A. Fabricate metal bollards from Schedule 40 steel pipe.
   1. Cap bollards with 1/4-inch- thick steel plate.
   2. Fill bollard with concrete.
   3. Galvanize for exterior locations.

2.14 MISCELLANEOUS FABRICATIONS

A. Elevator Sump Pit Covers and Supports: Fabricate covers from rolled-steel diamond plate, 1/4-inch thick minimum. Provide angle frame for opening size indicated. Frames shall be installed after concrete poured using expansion anchors.

2.15 SPIRAL STAIRS

A. Spiral Stairs: Maine Spiral Staircase, Turner, Maine; 207-713-9004.
   1. Steel frame and railing construction.
   2. 3/4-inch thick maple wood, 30 degree treads.
   3. Parallel rail, 8 line.
   4. Steel Finish: powder coat, color as selected by Architect.

B. Construction: IBC 2009 compliant.

2.16 ROUGH HARDWARE

A. Furnish bent, or otherwise custom-fabricated, bolts, plates, anchors, hangers, dowels, and other miscellaneous steel and iron shapes as required for framing and supporting woodwork, and for anchoring or securing woodwork to concrete or other structures. Straight bolts and other stock rough hardware items are specified in Division 06 Sections.

B. Fabricate items to sizes, shapes, and dimensions required. Furnish malleable-iron washers for heads and nuts that bear on wood structural connections, and furnish steel washers elsewhere.

2.17 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

2.18 STEEL AND IRON FINISHES

A. Galvanizing: Provide coating for iron and steel fabrications applied by the hot-dip process, 0.05 - 0.09% nickel content, Duragalv by Duncan Galvanizing, or approved equal. Provide thickness of galvanizing specified in referenced standards. Hot-dip galvanize items as indicated to comply with applicable standard listed below:
   1. ASTM A 123/A 123M, for galvanizing both fabricated and unfabricated steel and iron products made of uncoated rolled, pressed, and forged shapes, plates, bars, and strip 0.0299 inch thick or thicker.
   2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

3. Galvanizing shall exhibit a rugosity (smoothness) not greater than 4 rug (16-20 microns of variation) when measured by a profilometer over a 1-inch straight line on the surface of architectural and structural elements that are less than 24 pounds per running foot. Profilometer shall be capable of operating in 1 micron increments.

B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:
1. Exteriors (SSPC Zone 1B): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."

C. Shop Priming: Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installing anchorages, including concrete inserts, sleeves, anchor bolts, and miscellaneous items having integral anchors that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

B. Set sleeves in concrete with tops flush with finish surface elevations. Protect sleeves from water and concrete entry.

3.2 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are intended for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:
1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete inserts, toggle bolts, through bolts, lag bolts, wood screws, and other connectors.

3.3 INSTALLING HANDRAILS

A. Adjust railing systems before anchoring to ensure matching alignment at abutting joints.

B. Attach handrails to wall with wall brackets. Provide bracket with 1-1/2-inch clearance from inside face of handrail and finished wall surface. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads. Secure wall brackets to building construction as follows:
   1. For wood stud partitions, use hanger or lag bolts set into wood backing between studs. Coordinate with carpentry work to locate backing members.

3.4 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

B. Anchor supports for operable partitions securely to and rigidly brace from building structure.

3.5 INSTALLING PIPE BOLLARDS

A. Anchor bollards in place with concrete footings. Center and align bollards in holes 3 inches above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.

3.6 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
   1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 09 Section "Painting."

C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 055000

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

SECTION 061000 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Framing with dimension lumber.
2. Framing with engineered wood products.
3. Wall sheathing.
4. Roof sheathing.
5. Subflooring.
6. Shear wall panels.
7. Wood blocking and nailers.
8. Plywood backing panels.
9. Wood trim for fascia, rake and frieze boards to be aluminum clad.
10. Blocking for toilet accessories.
11. Blocking for Owner furnished items.

B. Related Requirements:
1. Division 06 Section "Metal-Plate-Connected Wood Trusses" for wood trusses made from dimension lumber.
2. Division 06 Section "Finish Carpentry" for composite decking for porches.
3. Division 07 Section "Weather Barriers" for water-resistive barrier at exterior walls.
4. Division 09 Section "Exterior Gypsum Sheathing" for weather-resistant gypsum wall sheathing.

1.3 DEFINITIONS

A. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.

B. Lumber grading agencies, and the abbreviations used to reference them, include the following:
1. NeLMA: Northeastern Lumber Manufacturers' Association.
2. NLGA: National Lumber Grades Authority.

1.4 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

physical properties of treated materials based on testing by a qualified independent testing agency.

3. For fire-retardant treatments, include physical properties of treated lumber and treated plywood both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5516 and ASTM D 5664.
4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

B. Shop Drawings for Panelized Construction Fabrication and Erection: This project is designed to be field constructed. If Contractor elects to use prefabricated wall, floor, and/or roof panels, the panels shall meet or exceed the framing designed in the Construction Documents and applicable code requirements. Review by Engineer is of structural elements only; dimensional review is specifically excluded for this scope. Contractor remains solely responsible for proper fit-up of panels. Review by Architect and Engineer of panel shop drawings shall be performed at Contractor's expense. Fee for a single review cycle will be $2,000 each for the Engineer and the Architect. Shop drawings shall include the following:

1. Include complete data for all framing materials, sheathing, and connection components.
2. Framing layouts for all panel assemblies as required to completely describe panel construction.
3. Sheathing lap details.
4. Provide fastener types, patterns, size (length and diameter), spacing and finish for all prefabricated panels including framing and sheathing conditions. Submit data for compliance with structural drawing requirements.
5. Provide field fastening and construction details, including panel-to-panel and panel-to-floor framing attachment requirements.
6. Submit tolerances for panel squareness, and dimensional tolerances for field assembly of panels (allowable growth/shortage of run of assembled panels).
7. Control of air infiltration at joints between panel sections. Extent of additional framing at panel joints.
8. Alternate framing connections that vary from design documents shall be submitted to the Engineer for approval prior to preparation of shop drawings. Acceptance of alternate framing connections is subject to Engineer's review based on to project conditions. Contractor is responsible to provide as-detailed conditions if alternate connections are not accepted.

C. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preservative-treated wood.
2. Fire-retardant-treated wood.
3. Engineered wood products.
4. Preservative-treated plywood.
5. Fire-retardant-treated plywood.
6. Power-driven fasteners.
7. Powder-actuated fasteners.
8. Expansion anchors.
9. Metal framing anchors.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1.5 QUALITY ASSURANCE

A. Source Limitations for Fire-Retardant-Treated Wood: Obtain each type of fire-retardant-treated wood product through one source from a single producer for both treatment and fire-retardant formulation.

B. Source Limitations for Engineered Wood Products: Obtain each type of engineered wood product through one source from a single manufacturer.

C. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Keep materials under cover and dry. Protect against exposure to weather and contact with damp or wet surfaces.

B. Stack lumber and panels flat with spacers beneath and between each bundle to provide air circulation. Protect lumber and panels from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.
   1. For lumber and panels pressure treated with waterborne chemicals, place spacers between each bundle to provide air circulation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS FOR SHEATHING

A. Fire-Test-Response Characteristics: For assemblies with fire-resistance ratings, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
   1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory."

2.2 WOOD AND PANEL PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
   1. Factory mark each piece of lumber with grade stamp of grading agency.
   2. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
   3. Provide dressed lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content of Lumber: 19 percent, unless otherwise indicated.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

C. Engineered Wood Products: Provide engineered wood products acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.
   1. Allowable Design Stresses: Provide engineered wood products with allowable design stresses, as published by manufacturer, that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

D. Plywood: DOC PS 1.

E. Thickness for Panel Products: As needed to comply with requirements specified, but not less than thickness indicated.

F. Factory mark panels to indicate compliance with applicable standard.

2.3 WOOD-PRESERVATIVE-TREATED LUMBER

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2.
   1. Preservative Chemicals: Micronized Copper Azole, MCA.
      a. Product: MicroPro/Life Wood; Osmose, Inc.

B. Kiln-dry material after treatment to a maximum moisture content of 19 percent for lumber. Do not use material that is warped or that does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

D. Application: Treat items indicated on Drawings, and the following:
   1. Wood sills and similar concealed members in contact with masonry or concrete.
   2. Wood framing members that are less than 18 inches above the ground in crawlspaces or unexcavated areas.
   3. Wood floor plates that are installed over concrete slabs-on-grade.
   4. Pressure-treat wood members in contact with the ground or fresh water with water-borne preservatives to a minimum retention of 0.40 pcf.
   5. Porch framing.
   6. Sleepers for porch decking over membrane roofing.

2.4 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
   1. Use treatment that does not promote corrosion of metal fasteners.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
4. Design Value Adjustment Factors for Lumber: Treated lumber shall be tested according ASTM D 5664 and design value adjustment factors shall be calculated according to ASTM D 6841.
5. Design Value Adjustment Factors for Plywood: Treated lumber plywood shall be tested according ASTM D 5516 and design value adjustment factors shall be calculated according to ASTM D 6305. Span ratings after treatment shall be not less than span ratings specified. For roof sheathing and where high-temperature fire-retardant treatment is indicated, span ratings for temperatures up to 170 deg F shall be not less than span ratings specified.

C. Kiln-dry material after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood. Do not use material that is warped or that does not comply with requirements for untreated material.

D. Identify fire-retardant-treated wood and plywood with appropriate classification marking of qualified testing agency.

E. Application: Treat items indicated on Drawings, and the following:
1. Blocking attached to steel framing this is receiving spray applied fireproofing.
2. Plywood backing panels.

2.5 DIMENSION LUMBER FRAMING

A. Studs, Joists, Rafters and Miscellaneous Framing: No. 2 or better grade.
1. Application: Load-bearing and Non-Load Bearing, studs, joists, rafters and miscellaneous framing.
2. Species: Spruce-pine-fir; NLGA or NeLMA.

2.6 ENGINEERED WOOD PRODUCTS

A. Source Limitations: Obtain each type of engineered wood product from single source from a single manufacturer.

B. Laminated-Veneer Lumber Beams, LVL: Structural composite lumber made from wood veneers with grain primarily parallel to member lengths, evaluated and monitored according to ASTM D 5456 and manufactured with an exterior-type adhesive complying with ASTM D 2559.
1. Basis of Design Product: Weyerhaeuser Company; TrusJoist Microllam LVL Beams.
2. Veneer Characteristics: Douglas fir or southern pine veneers of varying thickness by widths and lengths standard with manufacturer, end-jointed with a lap-joint, butt joint, or scarf joint. Architectural Grade exposed face.
3. Extreme Fiber Stress in Bending, Edgewise: 2900 psi for 12-inch nominal- depth members.
4. Modulus of Elasticity, Edgewise: 2,000,000 psi.
5. Tension Parallel to Grain: 1850 psi.

CITY OF PORTLAND, MAINE
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

6. Compression Parallel to Grain: 2800 psi.
7. Compression Perpendicular to Grain: 400 psi and 500 psi perpendicular and parallel to glue line.
8. Horizontal Shear: 285 psi and 190 psi perpendicular and parallel to glue line.

C. Preservative Treated Parallel-Strand Lumber, PSL: Preservative treated, structural composite lumber made from wood strand elements with grain primarily parallel to member lengths, evaluated and monitored according to ASTM D 5456 and manufactured with an exterior-type adhesive complying with ASTM D 2559.
1. Basis of Design Product: Weyerhaeuser Company; TrusJoist Parallam Plus PSL.
2. Extreme Fiber Stress in Bending, Edgewise: 2900 psi for 12-inch nominal- depth members.
3. Modulus of Elasticity, Edgewise: 2,000,000 psi.
4. Size: As indicated.
5. Preservative Chemical: Copper azole.

D. Parallel-Strand Lumber Columns, PSL: Structural composite lumber made from wood strand elements with grain primarily parallel to member lengths, evaluated and monitored according to ASTM D 5456 and manufactured with an exterior-type adhesive complying with ASTM D 2559.
1. Basis of Design Product: Weyerhaeuser Company; TrusJoist Parallam PSL Columns.
2. Extreme Fiber Stress in Bending, Edgewise: 2400 psi for 12-inch nominal- depth members.
3. Modulus of Elasticity, Edgewise: 1,800,000 psi.

E. Laminated-Strand Lumber: Lumber manufactured by laying up wood strands using an exterior-type adhesive complying with ASTM D 2559, and cured under pressure to produce members with grain of strands parallel to their lengths and complying with the following requirements:
1. Basis of Design Product: Weyerhaeuser Company; TimberStrand LSL
2. Extreme Fiber Stress in Bending: 2250 psi for 12-inch nominal depth members.
3. Modulus of Elasticity: 1,500,000 psi.

F. Rim Boards: Product designed to be used as a load-bearing member and to brace wood I-joists at bearing ends, complying with research/evaluation report for I-joists.
1. Manufacturer: Provide products by same manufacturer as I-joists.

2.7 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
1. Blocking and fillers.
2. Nailers.
3. Bay window framing, pent eave ledge framing, subfascia, and miscellaneous framing.

B. For items of dimension lumber size, provide No. 2 or better lumber for miscellaneous construction. Standard, Stud, or No. 3 grade lumber for blocking.
1. Species: Spruce-pine-fir; NeLMA or NLGA.

C. For concealed boards, provide lumber with 19 percent maximum moisture content and the following species and grades:
1. Spruce-pine-fir; Standard or No. 3 Common grade or better; NeLMA, or NLGA.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

D. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

2.8 WALL SHEATHING

A. Plywood Wall Sheathing and Shear Wall Sheathing: APA graded, Exposure 1, Structural I sheathing.
1. Nominal Thickness: Not less than 7/16-inch.
2. Species: Fir.

B. Oriented-Strand-Board Wall Sheathing and Shear Wall Sheathing: DOC PS 2, Exposure 1, Structural I sheathing.
1. Nominal Thickness: Not less than 7/16-inch.
2. Product: Allowed instead of plywood sheathing, except where fire-rated plywood is required; Huber Engineered Wood, AdvanTech VIP+ Sheathing Panel; no substitution.

2.9 ROOF SHEATHING

A. Plywood Roof Sheathing: APA graded, Exposure 1, Structural I sheathing.
1. Span Rating: Not less than 32/16.
2. Nominal Thickness: Not less than 3/4 inch, unless indicated otherwise.
3. Species: Fir.

B. Oriented-Strand-Board Roof Sheathing:
1. APA graded, Exposure 1, Structural I sheathing.
2. Nominal Thickness: Not less than 3/4 inch, unless otherwise indicated.
3. Edge: Square.
4. Product: Allowed instead of plywood sheathing; Huber Engineered Wood, AdvanTech VIP+ Sheathing Panel; no substitution.

C. Roof sheathing beneath decks that is receiving direct applied EPDM roof membrane shall be OSB sheathing.

2.10 SUBFLOORING

A. Plywood Subflooring: Exposure 1, Structural I single-floor panels or sheathing.
1. Edge Condition: Tongue and groove.
2. Nominal Thickness: Not less than 3/4 inch. 1 inch at location indicated.
3. Species: Fir.
4. Shall be fire retardant at stairs.

2.11 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2-inch nominal thickness.

2.12 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners of Type 304 stainless steel.
2. Where pressure-preservative treated lumber, panels or engineered lumber are used, provide Type 304 stainless steel fasteners.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: NES NER-272.

D. Wood Screws: ASME B18.6.1.

E. Lag Bolts: ASME B18.2.1.

F. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry assemblies and equal to four times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2.

2.13 METAL FRAMING ANCHORS

A. Manufacturer: Simpson Strong-Tie Co., Inc. or structural engineer approved equal.

B. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer, that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

C. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G185 coating designation.
1. Use G185 galvanized steel framing anchors for rough carpentry exposed to weather, in ground contact, exterior decks, pressure-preservative treated wood, or in area of high relative humidity, and where indicated.

D. Provide metal framing anchors as indicated on Structural Drawings.

2.14 MISCELLANEOUS MATERIALS

A. Sill-Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to suit width of sill members indicated.

B. Adhesives for Field Gluing Panels to Framing: Formulation complying with APA AFG-01 that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

PART 3 - EXECUTION

3.1 FRAMING INSTALLATION, GENERAL

A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.

B. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

C. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.

D. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant treated plywood backing panels with classification marking of testing agency exposed to view.

E. Metal Framing Anchors: Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

F. Install sill sealer gasket to form continuous seal between sill plates and concrete substrate.

G. Do not splice structural members between supports unless otherwise indicated.

H. Where built-up beams or girders of 2-inch nominal- dimension lumber on edge are required, fasten together with 2 rows of 20d nails spaced not less than 32 inches o.c., unless indicated otherwise Locate one row near top edge and other near bottom edge.

I. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

J. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated.

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

L. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

M. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
   1. NES NER-272 for power-driven fasteners.
   2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
   3. Published requirements of metal framing anchor manufacturer and indicated requirements on Structural Drawings.

N. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials.

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

1. Use hot-dip galvanized or stainless steel nails where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity.
2. Use stainless steel fasteners for fastening pressure preservative treated materials.

O. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced, and with adjacent rows staggered.

3.2 WOOD BLOCKING AND NAILER INSTALLATION

A. Install where indicated and where required for attaching other work. Install wood blocking and nailers to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, casework, furnishings, window treatment, handrail brackets, shelving, residential casework, building specialties, clothes rods, window sills, drywall window return shims, countertop supports, Owner furnished items, metal flashing, siding and trim support, roof blocking, base flashing backer, and equipment supports, or similar construction. Provide 3/4-inch thick plywood covering a minimum of 32 inches square for toilet accessories. Provide 1-1/2 inch thick solid blocking minimum, for grab bars, and handrail supports. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

1. Install blocking for grab bars, and handrail supports to withstand a downward load of at least 250 lbf, when tested according to method in ASTM F 446.
2. Provide concealed wood blocking behind gypsum wallboard where door stops are to be wall mounted.
3. Provide fire retardant treated wood for wood attached to steel beams and where indicated.
4. Provide blocking behind shower stalls for grab bars and shower doors.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated. Where possible, secure anchor bolts to formwork before concrete placement.

C. Porch Deck Sleepers on Membrane Roofing: Install tapered sleepers parallel with roof slope and with top of sleeper level. Sleepers shall be spaced 12 inches on center. Coordinate depth of sleepers to assure decking screws do not penetrate bottom of sleepers.

1. Provide a strip of .045 inch thick EPDM membrane adhered the bottom of each sleeper to protect roof membrane from damage. Do not use staples for attachment.
    a. Option; Apply loose laid sheet of EPDM over entire roof area below deck to act as a protection mat.

3.3 WALL AND PARTITION FRAMING INSTALLATION

A. General: Provide double bottom plates and double top plates using members of 2-inch nominal thickness whose widths equal that of studs, except provide triple top plates below roof framing. A single top plate may be used for non-load-bearing partitions. Fasten plates to supporting construction unless otherwise indicated.

1. For non-load bearing interior partitions and walls, provide 2-by-4-inch nominal- size wood studs spaced 16 inches o.c. unless otherwise indicated.
2. Provide continuous horizontal blocking at locations indicated, using members of 2-inch nominal thickness and of same width as wall or partitions.
3. Provide sill-sealer gaskets under exterior wall sill plates in contact with concrete.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

B. Construct corners and intersections with three or more studs, except that two studs may be used for interior non-load-bearing partitions.

C. Frame openings with multiple studs and headers. Provide nailed header members of thickness equal to width of studs. Support headers on jamb studs.
   1. For non-load-bearing partitions, provide double-jamb studs and headers not less than 4-inch nominal depth for openings 48 inches and less in width, 6-inch nominal depth for openings 48 inches and greater.
   2. For load-bearing walls, provide jamb studs and headers of depth and quantity indicated.

3.4 FLOOR JOIST FRAMING INSTALLATION

A. General: Install floor joists with crown edge up. Support ends of each member as indicated, or if not indicated with not less than 1-1/2 inches of bearing on wood or metal, or 3 inches on concrete. Attach floor joists as follows:
   1. Where supported on wood members, as indicated or, if not indicated, by using metal framing anchors.
   2. Where framed into wood supporting members, as indicated or, if not indicated, by using metal joist hangers.

B. Do not notch in middle third of joists; limit notches to one-sixth depth of joist, one-third at ends. Do not bore holes larger than 1/3 depth of joist; do not locate closer than 2 inches from top or bottom.

C. Provide solid blocking of 2-inch nominal thickness by depth of joist at ends of joists unless nailed to header or band.

D. Lap members framing from opposite sides of beams, girders, or partitions not less than 4 inches or securely tie opposing members together. Provide solid blocking of 2-inch nominal thickness by depth of joist over supports.

E. Anchor engineered framing with metal framing anchors, of size and type indicated.

F. Provide solid blocking between joists under jamb studs for openings.

G. Provide bridging where indicated on the Structural Drawings.

3.5 STAIR FRAMING INSTALLATION

A. Provide stair framing members of size, space, and configuration indicated or, if not indicated, to comply with the following requirements:
   1. Size: 2-by-12-inch nominal- size, minimum.
   2. Material: Laminated-veneer lumber, as indicated.
      a. Provide fire retardant material for egress Stair A and B.
   3. Notching: Notch rough carriages to receive treads, risers, and supports; leave at least 3-1/2 inches of effective depth.
   4. Spacing: 12 inches on center maximum.

B. Provide stair framing and treads with no more than 3/16-inch variation between adjacent treads and risers and no more than 3/8-inch variation between largest and smallest treads and risers

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

within each flight. Coordinate floor, landing and tread finish for thickness and proper riser heights.

C. Stair treads receiving carpet shall be Sturd-I-Floor underlayment plywood, fir or yellow pine.
   1. Provide fire retardant material for egress Stair A and B.

D. Glue and screw stair treads and risers to stair stringers.

E. Coordinate additional blocking for attachment of metal railing systems and for installation of wood newel post to receive stainless steel cable railing and handrail.

3.6 SHEATHING INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated, complying with the following:
   1. NES NER-272 for power-driven fasteners.
   2. Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code."

D. Use common wire nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.

E. Coordinate wall and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

G. Subflooring: Surfaces receiving glue shall be clean and dry. Do not install subfloor in temperatures below 20 degrees F and greater than 100 degrees F. Follow subfloor manufacturers installation requirements. For runs greater than 80 feet, follow manufacturer's expansion joint requirements and infill after building has dried-in. Gap end joints 1/8 inch.

H. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.7 WOOD STRUCTURAL PANEL INSTALLATION

A. General: Comply with structural drawings and applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.

B. Fastening Methods: Fasten panels as indicated below:

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1. Subflooring:
   a. Glue and nail to wood framing. Apply continuous adhesive bead in groove to receive panel tongue. Apply continuous adhesive beads to all structural framing members complying with sheathing manufacturer's requirements. Nailing pattern per structural drawing requirements. Remove excess adhesive squeeze out from panel face at joints.
   b. Space panels 1/8 inch apart at edges and ends.
2. Wall and Roof Sheathing:
   a. Nail to wood framing.
   b. Space panels 1/8 inch apart at edges and ends.
3. Plywood Backing Panels: Screw to supports.

END OF SECTION 061000

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

SECTION 06 19 20 – SHOP FABRICATED METAL-PLATE-CONNECTED WOOD TRUSSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes wood roof and girder trusses and truss accessories.

B. Related Sections include the following:

1. Division 6 Section "Rough Carpentry" for roof sheathing and subflooring and dimension lumber for supplementary framing and permanent bracing.

1.3 DEFINITIONS

A. Metal-Plate-Connected Wood Trusses: Planar structural units consisting of metal-plate-connected members fabricated from dimension lumber and cut and assembled before delivery to Project site.

B. Lumber grading agencies, and the abbreviations used to reference them, include the following:

1. NELMA - Northeastern Lumber Manufacturers Association.
2. NLGA - National Lumber Grades Authority.
3. SPIB - Southern Pine Inspection Bureau.
4. WCLIB - West Coast Lumber Inspection Bureau.
5. WWPA - Western Wood Products Association.

1.4 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide metal-plate-connected wood trusses capable of withstanding design loads within limits and under conditions indicated.

1. Design Loads: Live Loads as Indicated, plus snow drift and dead load
2. Maximum Deflection Under Design Loads:

a. Roof Trusses: Vertical deflection of L/360 SL, L/ 240 TL of span or 1” max.

b. Floor Trusses: Vertical deflection of L/600 LL, L/360 LT of span or 1” max.

1.5 SUBMITTALS

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

A. Product Data: For metal-plate connectors, metal framing anchors, bolts, and fasteners.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used, net amount of preservative retained, and chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated material.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements, including bending strength, stiffness, and fastener-holding capacity. Include physical properties of treated materials, both before and after exposure to elevated temperatures when tested according to ASTM D 5664.
3. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
4. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

B. Shop Drawings: Show location, pitch, span, camber, configuration, and spacing for each type of truss required; species, sizes, and stress grades of lumber; splice details; type, size, material, finish, design values, orientation, and location of metal connector plates; and bearing details.

1. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Product Certificates: For metal-plate-connected wood trusses, signed by officer of truss fabricating firm.

D. Qualification Data: For metal-plate manufacturer, professional engineer, fabricator and Installer.

E. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the American Lumber Standards Committee Board of Review.

F. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:

1. Preservative-treated wood.
2. Metal-plate connectors.
3. Metal framing anchors.

1.6 QUALITY ASSURANCE

A. Metal Connector-Plate Manufacturer Qualifications: A manufacturer that is a member of TPI and that complies with TPI quality-control procedures for manufacture of connector plates published in TPI 1.

1. Manufacturer's responsibilities include providing professional engineering services needed to assume engineering responsibility.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

2. Engineering Responsibility: Preparation of Shop Drawings and comprehens engineering analysis stamped by a qualified professional engineer.

B. Fabricator Qualifications: Shop that participates in a recognized quality-assurance program that involves inspection by SPIB, Timber Products Inspection, TPI, or other independent testing and inspecting agency acceptable to Architect and authorities having jurisdiction.

C. Source Limitations for Connector Plates: Obtain metal connector plates through one source from a single manufacturer.

D. Comply with applicable requirements and recommendations of the following publications:

1. TP1 1, "National Design Standard for Metal Plate Connected Wood Truss Construction."
2. TPI DSB, "Recommended Design Specification for Temporary Bracing of Metal Plate Connected Wood Trusses."
3. TPI HIB, "Commentary and Recommendations for Handling, Installing & Bracing Metal Plate Connected Wood Trusses."

E. Wood Structural Design Standard: Comply with applicable requirements in AFPA's "National Design Specifications for Wood Construction" and its "Supplement."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with TPI recommendations to avoid damage and lateral bending. Provide for air circulation around stacks and under coverings.

B. Inspect trusses showing discoloration, corrosion, or other evidence of deterioration. Discard and replace trusses that are damaged or defective.

1.8 COORDINATION

A. Time delivery and erection of trusses to avoid extended on-site storage and to avoid delaying progress of other trades whose work must follow erection of trusses.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Metal Connector Plates:

a. Alpine Engineered Products, Inc.
b. CompuTrus, Inc.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

c. Eagle Metal Products.
d. Jager Industries, Inc.
e. Mitek Industries, Inc.
f. Robbins Engineering, Inc.
g. TEE-LOK Corporation.
h. Truswal Systems Corporation.

2. Metal Framing Anchors:

a. Alpine Engineered Products, Inc.
b. Cleveland Steel Specialty Co.
c. Harlen Metal Products, Inc.
d. KC Metals Products, Inc.
e. Silver Metal Products, Inc.
f. Simpson Strong-Tie Company, Inc.
g. Southeastern Metals Manufacturing Co., Inc.
h. United Steel Products Company, Inc.

2.2 DIMENSION LUMBER

A. Lumber: DOC PS 20 and applicable rules of lumber grading agencies certified by the American Lumber Standards Committee Board of Review.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. For exposed lumber indicated to receive natural or stained finish, omit grade stamp and provide certificates of grade compliance issued by grading agency.
3. Provide dressed lumber, S4S, manufactured to actual sizes required by DOC PS 20 for moisture content specified.
4. Provide dry lumber with 19 percent maximum moisture content at time of dressing.
5. Provide dry lumber with 15 percent maximum moisture content at time of dressing.

B. Grade and Species: Provide dimension lumber of any species for truss chord and web members, graded visually or mechanically, and capable of supporting required loads without exceeding allowable design values according to AFPA's "National Design Specifications for Wood Construction" and its "Supplement."

C. Grade and Species: Provide visually graded dimension lumber for truss chord and web members, of the following any of the following species:
1. Species: Douglas fir-larch; WCLIB or WWPA.
2. Species: Douglas fir-south; WWPA.
3. Species: Douglas fir-larch (north); NLGA.
4. Species: Hem-fir; WCLIB or WWPA.
5. Species: Hem-fir (north); NLGA.
6. Species: Southern pine; SPIB.
7. Species: Mixed southern pine; SPIB.
8. Species: Spruce-pine-fir (south); NELMA, WCLIB, or WWPA.
9. Species: Spruce-pine-fir; NLGA.

D. Grade and Species: Provide dimension lumber of any species for truss chord and web members, graded as follows and of the following minimum design values for size of member required

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

according to AFPA's "National Design Specifications for Wood Construction" and "Supplement":

2.3 WOOD-PRESERVATIVE-TREATED LUMBER

A. Preservative Treatment by Pressure Process: AWPA C2, except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWPA C31 with inorganic boron (SBX).

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and the following:

    a. Ammoniacal copper zinc arsenate (ACZA).
    b. Ammoniacal, or amine, copper quat (ACQ).
    c. Copper bis (dimethyldithiocarbamate) (CDDC).
    d. Ammoniacal copper citrate (CC).
    e. Copper azole, Type A (CBA-A).
    f. Oxine copper (copper-8-quinolinolate) in a light petroleum solvent.

2. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.

B. Kiln-dry material after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.

C. Mark each treated item with the treatment quality mark of an inspection agency approved by the American Lumber Standards Committee Board of Review.

1. For exposed lumber indicated to receive a stained or natural finish, omit marking and provide certificates of treatment compliance issued by inspection agency.

2.4 METAL CONNECTOR PLATES

A. General: Fabricate connector plates to comply with TPI 1 from metal complying with requirements indicated below:

B. Hot-Dip Galvanized Steel Sheet: ASTM A 653/A 653M, G60 (Z180) coating designation; Designation SS, Grade 33, and not less than 0.036 inch (0.9 mm) thick.

C. Electrolytic Zinc-Coated Steel Sheet: ASTM A 591/A 591M, 80Z (24G) coating designation; ASTM A 570/A 570M, Structural Steel (SS), Grade 33, and not less than 0.047 inch (1.2 mm) thick.

2.5 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1. Where trusses are exposed to weather, in ground contact, or in area of high relat humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

B. Nails, Wire, Brads, and Staples: FS FF-N-105.

C. Power-Driven Fasteners: CABO NER-272.

D. Wood Screws: ASME B18.6.1.

E. Lag Bolts: ASME B18.2.1. (ASME B18.2.3.8M).

F. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.

G. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.

1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Grade A1 or A4).

2.6 METAL FRAMING ANCHORS

A. General: Provide framing anchors made from metal indicated, of structural capacity, type, and size indicated, and as follows:

1. Research/Evaluation Reports: Provide products acceptable to authorities having jurisdiction and for which model code research/evaluation reports exist that show compliance of metal framing anchors, for application indicated, with building code in effect for Project.
2. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer, that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

B. Galvanized Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 (Z180) coating designation.

C. Truss Tie-Downs (Hurricane or Seismic Ties): Bent strap tie for fastening roof trusses to wall studs below, 2-1/4 inches (57 mm) wide by 0.062 inch (1.6 mm) thick. Tie fits over top of truss and fastens to both sides of truss, face of top plates, and side of stud below.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

D. Roof Truss Clips: Angle clips for bracing bottom chord of roof trusses at non-load-bear walls, 1-1/4 inches (32 mm) wide by 0.050 inch (1.3 mm) thick. Clip is fastened to truss through slotted holes to allow for truss deflection.

2.7 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035, with dry film containing a minimum of 94 percent zinc dust by weight.

2.8 FABRICATION

A. Cut truss members to accurate lengths, angles, and sizes to produce close-fitting joints.

B. Fabricate metal connector plates to sizes, configurations, thicknesses, and anchorage details required to withstand design loads for types of joint designs indicated.

C. Assemble truss members in design configuration indicated; use jigs or other means to ensure uniformity and accuracy of assembly with joints closely fitted to comply with tolerances in TPI 1. Position members to produce design camber indicated.

1. Fabricate wood trusses within manufacturing tolerances in TPI 1.

D. Connect truss members by metal connector plates located and securely embedded simultaneously in both sides of wood members by air or hydraulic press.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install wood trusses only after supporting construction is in place and is braced and secured.

B. Before installing, splice trusses delivered to Project site in more than one piece.

C. Hoist trusses in place by lifting equipment suited to sizes and types of trusses required, exercising care not to damage truss members or joints by out-of-plane bending or other causes.

D. Install and brace trusses according to TPI recommendations and as indicated.

E. Install trusses plumb, square, and true to line and securely fasten to supporting construction.

F. Space trusses 16 inches (610 mm) o.c. as indicated; adjust and align trusses in location before permanently fastening.

G. Anchor trusses securely at bearing points; use metal framing anchors. Install fasteners through each fastener hole in metal framing anchor according to manufacturer's fastening schedules and written instructions.

H. Securely connect each truss ply required for forming built-up girder trusses.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1. Anchor trusses to girder trusses as indicated.

I. Install and fasten permanent bracing during truss erection and before construction loads are applied. Anchor ends of permanent bracing where terminating at walls or beams.

1. Install and fasten strongback bracing vertically against vertical web of parallel-chord floor trusses at centers indicated.

J. Install wood trusses within installation tolerances in TPI 1.

K. Do not cut or remove truss members.

L. Replace wood trusses that are damaged or do not meet requirements.

1. Do not alter trusses in field.

3.2 REPAIRS AND PROTECTION

A. Repair damaged galvanized coatings on exposed surfaces with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Protective Coating: Clean and prepare exposed surfaces of metal connector plates. Brush apply primer, when part of coating system, and one coat of protective coating.

1. Apply materials to provide minimum dry film thickness recommended by coating system manufacturer.

END OF SECTION 06 17 53

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

SECTION 062000 - FINISH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
1. Exterior standing and running fiber-cement trim and associated flashing.
2. Porch decking.
3. Interior standing and running trim for field finishing.
4. Vinyl ceilings.
5. Shelving and clothes rods.
6. Exterior deck railings.
7. Solid surface shower seats.

B. Related Sections include the following:
1. Division 05 Section "Ornamental Cable Railings" for cable railing material to be installed in conjunction with wood stair railing posts.
2. Division 09 Section "Wood Flooring" for quarter round installed in conjunction with wood flooring, and for wood flooring and nosing applied to stair treads and risers.
3. Division 09 Section "Painting" for priming and finishing of finish carpentry.
4. Division 07 Section "Fiber-Cement Siding" for exterior fiber-cement siding, and sealants in conjunction with siding.

1.3 SUBMITTALS

A. General: Submit in accordance with Division 01 Section "Submittal Procedures."

B. Product Data: For each type of process and factory-fabricated product. Include construction details, material descriptions, dimensions of individual components and profiles, textures, and colors.

C. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

D. Maintenance Data: For finishes to include in the operation and maintenance manual specified in Division 01. Include cleaning methods, cleaning solutions recommended, and stain removal methods recommended. Also include precautions for cleaning materials and methods that could be detrimental to finishes and performance.

E. Warranties: Special warranties specified in this Section.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has completed finish carpentry similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

B. Source Limitations for Fiber-Cement Trim: Obtain all composite trim through one source from a single manufacturer that is the same manufacturer as the siding.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Keep materials under cover, off ground, and dry. Protect materials against weather and contact with damp or wet surfaces. Stack lumber, plywood, and other panels flat with spacers between each bundle to provide air circulation. Provide for air circulation within and around stacks and under temporary coverings.

B. Deliver interior finish carpentry only when environmental conditions meet requirements specified for installation areas. If interior finish carpentry must be stored in other than installation areas, store only where environmental conditions meet requirements specified for installation areas.

C. Fiber-Cement Trim:
1. Deliver fiber-cement trim so as not to be damaged or deformed. Package fiber-cement trim for protection during transportation and handling.
2. Store fiber-cement trim materials at site to prevent warping and weather damage, elevating above ground on level blocking and covering with colored tarp to prevent green-housing and water intrusion from top and sides but permitting adequate ventilation within bundles. Protect corners and edges from chipping.
    a. Store fiber-cement trim to protect it from becoming wet. If trim becomes wet, allow both faces, edges and ends of trim to completely dry prior to installation. Failure to properly protect trim may result in discoloration of trim that Contractor shall remove prior to Substantial Completion.

1.6 PROJECT CONDITIONS

A. Weather Limitations for Exterior Finish Carpentry: Proceed with installation only when existing and forecasted weather conditions permit work to be performed according to manufacturer's written instructions and warranty requirements and at least one coat of specified finish to be applied without exposure to rain, snow, or dampness.

B. Environmental Limitations for Interior Finish Carpentry: Do not deliver or install interior finish carpentry until building is enclosed and weatherproof, wet work in space is completed and nominally dry, and provisions are made to maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.

C. Do not install finish carpentry materials that are wet, moisture damaged, or mold damaged.
1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufactures specified.
   2. Products: Subject to compliance with requirements, provide one of the products specified.

2.2 MATERIALS, GENERAL

A. Lumber: DOC PS 20 and applicable grading rules of inspection agencies certified by the American Lumber Standards' Committee Board of Review.
   1. Factory mark each piece of lumber with grade stamp of inspection agency indicating grade, species, moisture content at time of surfacing, and mill.

B. Solid-Surfacing Material: Homogeneous solid sheets of filled plastic resin complying with ISSFA-2.
   1. Type: Standard type.
   2. Colors and Patterns: As selected by Architect from manufacturer's full range.

2.3 CUSTOM INTERIOR STANDING AND RUNNING TRIM FOR TRANSPARENT FINISH

A. Quality Standard: Comply with AWI's Standards Section 6 - Interior & Exterior Millwork requirements for wood standing and running trim.

B. Grade: Custom.

C. Wood Species and Cut: Select white maple, plain sawn or sliced.

2.4 CUSTOM INTERIOR STANDING AND RUNNING TRIM FOR OPAQUE FINISH

A. Quality Standard: Comply with AWI's Standards Section 6 - Interior & Exterior Millwork requirements for wood standing and running trim.

B. Grade: Custom.

C. Wood Species: Poplar, birch or any closed-grain white hardwood.

2.5 FIBER CORE CANOPY CEILINGS

A. Wood Fiber Core Ceilings: Trespa Pura NFC Flush Siding with concealed fasteners, wood fibers impregnated with thermosetting resins.
   1. Provide one piece, full length of run to the maximum extent possible.

B. Perimeter Trim: Extruded aluminum, finish to coincide with panel color.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

2.6 EXTERIOR VINYL CEILINGS

A. Vinyl Ceiling: Integrally colored, vinyl soffit complying with ASTM D 4477.
   1. Pattern: Double 5-inch exposure in v-board style.
   2. Texture: Smooth matte.
   3. Ventilation: None.
   4. Thickness: Not less than 0.038 inch.
   5. Minimum Profile Height: 7/16 inch.
   6. Fire Rating: ASTM E84 Class A. ASTM D653, self-extinguishing.
   7. Trim: Provide matching Soffit Cove Trim at edges.
   8. Colors for Vinyl Soffit: As selected by Architect from manufacturer's full range.
   9. Product: CertainTeed Corp.; Vinyl Carpentry Value Soffit.

2.7 PORCH DECKING

A. Porch Deck: Composite material of polypropylene and hardwood fibers with antimicrobial protection, stain- and scratch-resistant and fade-resistance; edges shall be grooved for concealed fastener attachment.
   1. Size: 5/4 by 6 inches.
   2. Texture: Woodgrain.
   3. Color: As selected by Architect.
   4. Product: Fiberon Classic.
   5. Porch Deck Fastener System: Stainless steel hidden fastening system by one of the following:
      a. FastenMaster; TigerClaw TC-3S Hidden Deck Fastener.
      b. HIDfast, Inc.; HF3 Hidden Fastening System.
   6. Exposed Fasteners: Where exposed fasteners are necessary, provide non-corrosive screw deck fastener with colored head to blend with decking color.

2.8 STOCK INTERIOR STANDING AND RUNNING TRIM

A. Stock Profile Moldings: Wood moldings made from kiln-dried stock and graded under WMMPA WM 4.
   1. Moldings for Opaque Finish (Painted): P-grade eastern white pine Idaho white, lodgepole, ponderosa, or sugar pine, or poplar.
      a. Profiles: As indicated.
      b. Manufacturer: Forester Moulding & Lumber, Inc.; Brockway Smith Company Brosco Trim.

B. MDF Baseboard Trim: MDF trim boards, factory primed complying with ANSI A208.2, Grade MD.
   1. Product: Pacific MDF Products, Inc.; PacTrim with PacPrime finish.
   2. In addition to factory primer on exposed face and edges, back prime and prime all edges before installation.

2.9 SHELVING

A. Shelving: 3/4-inch particleboard shelving with radiused and filled front edge, or square edge with PVC edging

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1. Shelf Cleats: 3/4-by-3-1/2-inch boards, of same species and grade indicated above for interior lumber trim for opaque finish.
2. Shelf Brackets: Prime-painted formed steel, with provision to support clothes rod where rod is indicated. Provide one bracket for shelves greater than 4 feet in length and 2 brackets for shelves greater than 6 feet.
3. Clothes Rods: Knape and Vogt 750 5 chrome look 1-5/16 inch round tubing, .075 inch wall thickness. KV 764 sockets.

2.10 EXTERIOR DECK RAILINGS.

A. Exterior Railings: Prefinished 6063 extruded aluminum alloy baluster and railing system.
1. Product: Trex Reveal Railing.
   a. Railing Height: 42 inches.
   b. Railing Profile: Radius top profile.
   c. Balusters: Square.
   d. Posts: Aluminum square with cap and skirt. Provide with aluminum base plate, back plate and stainless steel leveling shims.
      1) At wood posts, provide composite post sleeve with cap and skirt.
   e. Mounting: Top and bottom fixed railing brackets and covers.
      1) Provide screw fasteners of sufficient size and length to penetrate through trim into solid wood blocking to support code compliant loading requirements.
   f. Support Blocks: Aluminum bottom rail support foot block and connectors. Provide two supports per length of railing, located at third points.
   g. Fasteners: Stainless steel. Finish to match railings for exposed fasteners.
   h. Finish: AAMA 2604 powder coat finish.
   i. Code Compliance: Railing system and installation shall be IBC compliant.

2.11 FIBER-CEMENT TRIM

A. General: ASTM C 1186, Type A, Grade II, fiber-cement board, noncombustible when tested according to ASTM E 136; with a flame-spread index of 25 or less when tested according to ASTM E 84; does not contain asbestos fibers; and has the following characteristics:
1. Flexural Strength: ASTM C 1185, at least 1450 psi when in equilibrium condition, and at least 1015 psi when in wet condition.
2. Coefficient of Thermal Expansion: ASTM E 228, less than 1 x 10^-5/inch/inch/degree F.
3. Freeze Thaw Resistance: ASTM C 1185, at least 80 percent flexural strength retained.
4. UV Resistance: ASTM G 26, no cracking, checking, or erosion, when tested for 2000 hours.
5. Water Tightness: ASTM C 1185, no water droplets on underside.

B. Fiber-Cement Trim: Boards of the size and thickness indicated; smooth texture.
1. Finish: Manufacturer's Factory finish.
2. Product: Same manufacturer as siding, Allura Plycem Smooth Trim or James Hardie HardieTrim NT3.
   a. Fascia: 4/4 Fiber Cement Trim.
   b. Trim in Conjunction with Siding: 5/4 Fiber Cement Trim.

C. Fiber Cement Soffit (Pent Eave): Flat panels as follows:

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1. Continuous Eave Soffit Board: Non-ventilated, required width, 1/4 inch thick by 12 feet long, with smooth texture.
2. Finish: Manufacturer's Factory finish.
3. Product:
   a. Allura Soffit, Plycem USA.
   b. James Hardie, HardieSoffit.

D. Fasteners:
   1. For fastening to wood, use stainless steel, ribbed bugle-head screws and nails of sufficient length to penetrate through gypsum sheathing and plywood, and a minimum of 1-1/4 inch into wood framing substrate.

2.12 MISCELLANEOUS MATERIALS

A. Fasteners for Exterior Finish Carpentry: Provide nails or screws of the following materials, in sufficient length to penetrate minimum of 1-1/2 inches into substrate, unless otherwise recommended by manufacturer:
   1. Stainless steel.
   2. Hot-dip galvanized steel.
   3. Noncorroding aluminum.

B. Fasteners for Interior Finish Carpentry: Nails, screws, and other anchoring devices of type, size, material, and finish required for application indicated to provide secure attachment, concealed where possible.
   1. Where finish carpentry materials are exposed in areas of high humidity, provide fasteners and anchorages with hot-dip galvanized coating complying with ASTM A 153/A 153M.

C. Interior Trim Glue: Titebond III or Molding and Trim glue.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine finish carpentry materials before installation. Reject materials that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of projections and substances detrimental to application.

B. Before installing interior finish carpentry, condition materials to average prevailing humidity in installation areas for a minimum of 24 hours, unless longer conditioning is recommended by manufacturer.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

3.3 INSTALLATION, GENERAL

A. Do not use materials that are unsound, warped, improperly treated or finished, inadequately seasoned, or too small to fabricate with proper jointing arrangements.
   1. Do not use manufactured units with defective surfaces, sizes, or patterns.

B. Install finish carpentry level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment.
   1. Scribe and cut finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
   2. Countersink fasteners, fill surface flush, and sand where face fastening is unavoidable.
   3. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.
   4. Coordinate finish carpentry with materials and systems in or adjacent to it. Provide cutouts for mechanical and electrical items that penetrate exposed surfaces of finish carpentry.
   5. Finish according to specified requirements.
   6. Refer to Division 09 Section "Painting" for final finishing of finish carpentry.

3.4 INSTALLATION OF FIBER-CEMENT TRIM

A. General: Comply with trim manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply. Install trim as indicated and as recommended by trim manufacturer. Install trim with tolerances and fastener spacings as recommended by manufacturer.
   1. Do not install damaged components.
   2. Pre-drill holes for fasteners if necessary to prevent breakage.
   3. Space fasteners at 12 to 16 inches o.c. maximum. Do not fasten closer than 3/8 inch from edges. Do not over drive fastener. Fill screw slots with sealant; do not smear on to face of trim.
   4. Field cuts shall be sealed with one coat of finish before installing. Allow coating to dry before caulking.
   5. Allow uniform 1/8-inch gap at trim joints and where siding abuts trim. Use gauge block to assure proper spacing. Caulk joints, filling 1/8-inch wide joint to a depth of not less than 3/16-inch. Do not smear caulk on to face of trim. Comply with installation requirements of Division 07 Section "Joint Sealants."

B. Trim: Install with minimum number of joints practical, using full-length pieces from maximum lengths of material available. Do not use pieces less than 3 feet long, except where necessary. Stagger joints in adjacent and related standing and running trim. End-to-end joints shall be caulked.

C. Pent eave soffits shall be nailed along front and back edge at 12 inches on center. At butt joints, provide 2 by framing backer behind joint and fasten soffit. Do not fasten closer than 2 inches from corners in either direction and no closer than 3/8 inch from edges. Do not over drive fastener. Back of head of fastener shall be flush with face of panel. Pre-drill counter sink holes for screws if required to flush heads with surface without pulverizing panel.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

3.5 VINYL CEILING INSTALLATION

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

B. Install soffit cove trim at edges. Miter corners.

C. Install vinyl soffit, and accessories according to ASTM D 4756.
1. Ceiling material less runs 12 feet and less shall be installed as full length, one-piece sections without lap joints. For runs greater than 12 feet, provide at least courses between aligning lap joints and at least 4 feet horizontally between lap joints in adjacent courses. Do not use any piece less than 3 feet long.

3.6 PORCH DECKING INSTALLATION

A. Install decking in one piece without butt joints where runs do not exceed manufactured lengths. Where runs exceed maximum available lengths, stagger joints not less than 32 inches, with adjacent joints at least 3 board widths apart.

B. Fasten decking with concealed fastener system. At narrow end of sleepers, use fasteners of a length that will not penetrate through sleeper and damage EPDM roofing below sleeper.

3.7 EXTERIOR RAILING INSTALLATION

A. Railings: Install railings in accordance with manufacturer's instructions. Railings shall be installed level and plumb, with face of railings located at a uniform distance from face of trim, and of uniform height above finish decking. Cut railings to provide equal distance at each end between balusters and trim. Space between balusters and trim shall not exceed 4 inches.

B. Secure wall rails with metal brackets. Provide stainless steel fasteners of sufficient size and length to penetrate through trim into solid wood blocking to support code compliant loading requirements.
1. Structural Performance of Railings: Railings shall withstand the effects of gravity loads, the requirements of IBC 2009, loads and stresses within limits and under conditions indicated:
a. Uniform load of 50 lbf/ ft. applied in any direction.
b. Concentrated load of 200 lbf applied in any direction.
2. Uniform and concentrated loads need not be assumed to act concurrently.
3. Provide isolation material between aluminum components and preservative treated wood.

3.8 INTERIOR STANDING AND RUNNING TRIM

A. Install with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 24 inches long, except where necessary. Stagger joints in adjacent and related standing and running trim. Cope at returns and miter at corners to produce tight-fitting joints with full-surface contact throughout length of joint. Use scarf joints for end-to-end joints. Plane backs of casings to provide uniform thickness across joints where necessary for alignment.
1. Match color and grain pattern of trim for transparent finish (stain or clear finish) across joints.
2. Install trim after gypsum board joint finishing operations are completed.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

3. Drill pilot holes in hardwood before fastening to prevent splitting. Fasten to prevent movement or warping. Countersink fastener heads on exposed carpentry work and fill holes.
4. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches.
5. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
6. Prime and back prime all uncoated surfaces of MDF trim before installing. Seal cut joint surfaces with wood glue when assembling and fastening. Conceal cut edges to the maximum extent possible.
7. Wall Caps: Secure with countersunk head wood screws in concealed locations. Install with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 24 inches long, except where necessary. Use scarf joints for end-to-end joints.

3.9 SHELVING AND CLOTHES ROD INSTALLATION

A. Closet Install shelf cleats by fastening to framing or backing with finish nails or trim screws, set below face and filled. Space fasteners not more than 16 inches o.c. Use 2 fasteners at each framing member.

B. Install rod flanges for clothes rods. Fasten to shelf cleats. Install rods in rod flanges.

3.10 SHOWER SEATS

A. Coordinate with tile and waterproofing installation.

B. Fabricate to detail from solid surface material one piece full width and depth. Provide radius edge at exposed edge along seat front.

C. Set screw fasteners in sealant, counter sink, conceal with matching solid surface plugs, and finish flush to match surrounds seat finish.

3.11 ADJUSTING

A. Replace finish carpentry that is damaged or does not comply with requirements. Finish carpentry may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing. Adjust joinery for uniform appearance.

3.12 CLEANING

A. Clean finish carpentry on exposed and semiexposed surfaces. Touch up factory-applied finishes to restore damaged or soiled areas.

3.13 PROTECTION

A. Protect installed products from damage from weather and other causes during remainder of the construction period.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

B. Remove and replace finish carpentry materials that are wet, moisture damaged, and mold damaged.
   1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
   2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

C. Provide final protection and maintain conditions that ensure finish carpentry is without damage or deterioration at the time of Substantial Completion.

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Inspections Division
Approved with Conditions
Date: 04/11/17

SECTION 071000 - CEMENTITIOUS WATERPROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes cementitious waterproofing for elevator pits.

B. Related Sections include the following:
1. Division 03 Section "Cast-In-Place Concrete."

1.3 SUBMITTALS

A. General: Submit in accordance with Division 01 Section "Submittal Procedures."

B. Product Data: For each type of product indicated, including installation instructions.

C. Qualification Data: For Installer.

1.4 QUALITY ASSURANCE

A. Applicator Qualifications: Engage an experienced waterproofing Applicator.

B. Source Limitations: Obtain cementitious waterproofing materials through one source from a single manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials and equipment in a single area of project site. Provide adequate means to protect floors and adjacent surfaces of this area from damage.

1.6 PROJECT CONDITIONS

A. Weather Limitations: Do not apply waterproofing when effects of freezing or moisture will adversely affect the waterproofing application.

B. Maintain adequate ventilation during preparation and application of cementitious waterproofing materials.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cementitious Waterproofing: "Five Star Waterproofing" trowel applied negative side cementitious membrane and mixing liquid system manufactured by WCM.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Applicator present, for compliance with requirements for surface smoothness and other conditions affecting performance of work.
   1. Verify that concrete has cured and aged for minimum time period recommended by waterproofing manufacturer.
   2. If unacceptable conditions are encountered, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
   3. Application of coating to surfaces shall constitute acceptance of surfaces and conditions.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surfaces must be clean. Chip or grind off all defective materials and foreign matter. Remove form treatment residue, curing compound, scum, dirt and fungus.

B. Repair cracks, breaks, honeycombing, or other surface imperfections with non-expansive patching mortar to attain a finish comparable to adjacent concrete surfaces.

3.3 INSTALLATION

A. Cementitious Waterproofing:
   1. Apply cementitious waterproofing treatment to the floor and walls of elevator pit to a minimum thickness of 1/8-inch after elevator jack hole has been poured around with cast-in-place concrete.
   2. Trowel all surfaces to a smooth, hard finish, free from pits hollows and other defects.
   3. Provide 1-inch by 1-inch cant at intersection of horizontal and vertical surfaces.
   4. Apply in strict accordance with manufacturer's instructions.

3.4 PROTECTION

A. Protect waterproofing from damage by other trades after installation to maintain the integrity of the waterproofing.

END OF SECTION 071000

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

SECTION 072100 - BUILDING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Foam-plastic board insulation.
2. Dense pack cellulosic insulation.
3. Foam-in-place insulation sealant.
4. Insulation in frames of steel doors and louvers.
5. Vapor retarder membrane.

B. Related Sections:
1. Division 07 Section "Spray-In-Place Rigid Urethane Foam Insulation."
2. Division 07 Section "Under-Slab Vapor Retarders."
3. Division 07 Section "Ethylene-Propylene-Diene-Monomer (EPDM) Roofing" for insulation and vapor retarder specified as part of roofing construction.
4. Division 09 Section "Gypsum Board Assemblies" for provision in wood- and metal-framed assemblies of acoustical insulation.
5. Division 1522 and 23Sections for insulation on ducts, piping, and equipment.

1.3 DEFINITIONS

A. Thermal Resistivity: Where the thermal resistivity of insulation products are designated by "r-values," they represent the reciprocal of thermal conductivity (k-values). Thermal conductivity is the rate of heat flow through a homogenous material exactly 1 inch thick. Thermal resistivities are expressed by the temperature difference in degrees F between the two exposed faces required to cause one BTU to flow through one square foot per hour at mean temperatures indicated.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Qualification Data: For Installer of dense pack cellulosic insulation.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.

1.5 QUALITY ASSURANCE

A. Installer of Dense Pack Cellulose Insulation: A firm experienced and with sufficient trained staff to install manufacturer's products according to specified requirements. Installer shall have

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

not less than 5 years experience, and shall have completed not less than 5 projects of similar size and complexity. Submit not less than three references of projects of similar size and complexity. Include name of Architect and Owner.

B. Source Limitations: Obtain each type of building insulation through one source from a single manufacturer.

C. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency and bearing UL label. Identify products with appropriate markings of applicable testing agency.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect foam-plastic board insulation as follows:
1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site before installation time.
3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
2. Products: Subject to compliance with requirements, provide one of the products specified.

2.2 FOAM-PLASTIC BOARD INSULATION

A. Under Slab and Perimeter Extruded-Polystyrene Board Insulation: ASTM C 578, Type IV, 25 psi, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.
1. Edge Condition: Square edge.
2. Thickness: 2 inch, unless indicated otherwise.
3. Products:
a. CertiFoam 25 SE; DiversiFoam Products.
b. Styrofoam; Dow Chemical Company (The).
c. Foamular 250; Owens Corning.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

B. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

2.3 LOOSE-FILL INSULATION

A. Cellulosic-Fiber Insulation: ASTM C 739, made from high grade, recycled newsprint and chemically treated with all-borate for flame-resistance, processing, and handling characteristics.
   1. Thermal Value: R-3.8 per inch.
   2. Thickness: Full depth of cavity.
   3. Density: Apply to a nominal density of 3.5 lbs./cu. ft.
   4. UL Classification: Shall comply with UL R-8078 for combustibility.
   5. Product: Nu-Wool, Inc.; Nu-Wool Premium Cellulose Insulation.

B. Netting for Spray-Applied Cellulosic Insulation (Interior to interior applications only. For insulated walls and floor to unheated conditions use Vapor Retarder Membrane.): Non-woven polyester netting material for containment of cellulose insulation.
   1. Product: Hanes Industries, Insulweb, Style No. 3121; phone: (800) 699-6898.

2.4 VAPOR RETARDER MEMBRANE

A. Vapor Retarder Membrane (Walls): INTELLO Plus, smart vapor retarder, 8-mil thick polyethylene copolymer membrane with polypropylene reinforcement grid film permitting two-way vapor diffusion. Permeance of 13.20 to 0.17. Maximum Flame Spread Index; 20. Maximum Smoke Developed Index; 55. Roll width as required by wall height by continuous roll length. Membrane shall act as fabric for dens pack insulation.
   1. Contact: 475 High Performance Building Supply; 718-622-1600; foursevenfive.com
   2. Vapor Retarder Tape: Tescon No. 1 and Tescon Profil Corner Tape, pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.
   3. Vapor Retarder Sealant: Orcon F recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.
      a. Perimeter Seal: Sealant or tape as recommended by vapor-retarder manufacturer.

B. Vapor-Retarder Fasteners: Staples for wood framing, 1/2-inch crown by 5/16-inch long minimum.

2.5 FOAM-IN-PLACE INSULATION SEALANT

A. Polyurethane Foam Insulation Sealant (Minimal Expansive) for Window and Door Perimeters: Single- or two-component, UL classified sealant, to insulate, seal, fill, and stop air infiltration; shall not expand to the point to cause pressure on window and door jambs.
   1. Density: ASTM D 1622, 1.0 - 1.8 lbs./cu. ft.
   2. R-Value: ASTM C 518, not less than 4.0 per inch of thickness.
   3. Fire-Test-Response Characteristics: ASTM E 84, as follows:
      a. Flame Spread: Not greater than 25.
      b. Smoke Developed: Not greater than 50.
   4. Products:
      a. Dow Chemical Company (The); Great Stuff PRO Window & Door.
      b. Fomo Products Inc.; Handi-Seal Window and Door Sealant.
      c. Convenience Products; No-Warp Foam Window & Door Insulating Sealant.

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

2.6 AUXILIARY INSULATING MATERIALS

A. Air-Vapor Barrier Box: Air-vapor barrier box, constructed of high strength polyethylene with sealing flanges to permit installation of electrical boxes, insulation, and installation of wallboard without damage to vapor barrier.
   1. Coordinate installation and provide installation instructions to electrician during electrical rough-in.
   2. Product: LESSCO Air-Vapor Barrier Box; Lessco Low Energy Systems Supply Co., Inc., Campbellsport, WI 53010; phone: 920-533-8690; e-mail: LESSCO@lessco-airtight.com.

B. Recessed light Fire Protection Covers: Tenmat Insulation Protection Cover constructed of fire safe mineral wool. Select size and style for field conditions.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to insulation or vapor retarders, including removing projections capable of puncturing vapor retarders, or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated. Fill voids in thermal envelope not covered by the work of other sections.
   1. If printed instructions are not available or do not apply to project conditions, consult manufacturer's technical representative for specific recommendations before proceeding with installation of insulation.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.3 INSTALLATION OF BELOW-GRADE INSULATION

A. On vertical footing and foundation wall surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.
   1. Extend insulation to top of footing, unless otherwise indicated.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

3.4 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, use supports with mechanical anchorage to provide permanent placement and support of units. Fill voids in thermal envelope not covered by the work of other sections.

B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation.

C. At perimeter band joists, conditions ad underside of decks and between joists, bay window conditions, locations where dense pack netting and vapor retarder membrane would not be fully supported by gypsum wallboard insulation, and locations indicated, shall be insulated with spray foam insulation specified in Section 072110 - Spray-In-Place Rigid Urethane Foam Insulation.

3.5 INSTALLATION OF DENSE PACK CELLULOSE INSULATION

A. General: Apply netting and vapor retarder membrane support, and cellulose insulation according to manufacturer's written instructions. Do not apply insulation until installation of pipes, ducts, conduits, wiring, recessed lighting, electrical outlets and miscellaneous items in walls and ceilings is completed.

B. Preparation: Verify all work within wall cavities is complete. Sweep and vacuum the bottom of stud cavities, top plates, floors and other contaminated and dust coated surfaces clean to contamination of recycled material.
1. Seal vertical plumbing and electrical penetrations through both top and bottom plates with foam sealant.
2. Seal all openings that cellulose insulation could leak out of to maintain installed density and prevent voids
3. Fill voids less than one inch in width with foam insulation.
4. Install recessed light fire protection covers at recessed lights and fixtures.
5. Install air-vapor barrier boxes at wall outlet boxes, and ceiling outlet boxes where cellulose insulation is located.
    a. Air-Vapor Barrier Box: Installation: Seal vapor retarder to air-vapor barrier box in accordance with manufacturer's instructions, http://www.lessco-airtight.com/instructions.htm. Seal completely around wires with silicone sealant. If the hinged box option is used by electrical box installer, the cut made at top and bottom of the box shall be taped shut with 3M Contractor's Sheathing Tape. Cut vapor retarder at center of flanges of air-vapor barrier box and tape the vapor retarder to flanges of the air-vapor barrier box with vapor barrier tape, assuring tape is folded into the insides of the air-vapor barrier box.
    b. Seal vapor retarder to electrical boxes..

C. Insulation Support: Provide continuous fabric stretched tight and double row and inset stapled in a manner that draws the material taught, prevent cellulose from coming between face of studs that would interfere with wallboard installation, and prevent cellulose from bulging out beyond face of framing.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1. Interior Floor to Floor Conditions: Use netting as fabric support of insulation. Install netting before the installation of ceiling furring. Seal netting to recessed lighting insulated covers.
   a. Tape cuts in netting made for installation of insulation.
2. Exterior Walls: Use vapor retarder membrane as fabric support of insulation. Install and seal in accordance with vapor retarder manufacturer instructions.
   a. Extend vapor retarders to extremities of areas to protect from vapor transmission. Secure vapor retarders in place with staples. Extend vapor retarders to cover miscellaneous voids in insulated substrates.
   b. Overlap rows of membrane and seal joints with vapor retarder tape.
   c. Set perimeter edges in vapor retarder sealant. Set perimeter edges around window and door openings in vapor retarder sealant.
   d. Seal vapor retarder membrane to air-vapor barrier boxes.
   e. Tape cuts in vapor retarder membrane made for installation of insulation with vapor retarder tape.
   f. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarders.

D. Dry-Dense Packing: Install dry dense-pack cellulose insulation.
1. Use proper equipment that is capable of steady blower pressure at required pressure setting to achieve required density.
2. Fill cavities to attain a minimum installed density of 3.5 pounds per cubic foot. Do not use reclaimed material. Tape the cuts in the fabric after the material is installed.
   a. Take core samples from the top, middle and bottom of the first cavity for each day's placement to ensure proper technique and consistent density.
3. Roll along the middle of each cavity with an insulation roller to assure bulging does not interfere with installation of drywall.

3.6 INSTALLATION OF FOAM-IN-PLACE INSULATION SEALANT

A. Install foam-in-place insulation sealant to a minimum depth of 1inch, sealing construction cracks and gaps where outside air and cold can infiltrate, providing an airtight building envelope.

B. Seal around wires, piping, conduit, and other penetration items running through top and bottom plates in exterior walls, and through the top plates of top story interior and exterior walls.

3.7 INSULATING STEEL DOOR AND LOUVER FRAMES

A. Exterior Frames: Steel door frames in exterior walls and louver frames shall be filled with rigid insulation. Cut rigid insulation slab the full width of frame throat and insert continuous slab into door frame and louver frame head and jambs before frame is installed.
1. Foam remaining gaps with minimal expanding foam.

3.8 PROTECTION

A. Protect installed insulation and vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 072100

62 India Str
Portland, M
DD

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

SECTION 072110 - SPRAY-IN-PLACE RIGID URETHANE FOAM INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes spray polyurethane foam insulation.

B. Related Sections include the following:
1. Division 07 Section "Building Insulation" for miscellaneous foam sealant.

1.3 SUBMITTALS

A. General: Submit in accordance with Division 01 Section "Submittal Procedures."

B. Product Data: For each type of product indicated.
1. Submit catalyst and temperature requirements for its use.
2. Preparation instructions and recommendations.
3. Storage and handling requirements and recommendations.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.

D. Qualification Data: For Installer signed by manufacturer certifying that Installers comply with requirements. Submit list of similar type projects along with the Architect and Owner contact information for each project.

E. Report of Framing and Sheathing Temperatures: Submit report of framing and sheathing temperatures taken prior to application of spray polyurethane foam insulation.

F. Evaluation Reports: For spray-applied polyurethane foam-plastic insulation, from ICC-ES.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Shall be approved in writing by spray polyurethane foam insulation manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers with labels indicating manufacturer, product name and designation, and directions for storing and mixing with components.

B. Store and handle materials in compliance with manufacturer's recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

causes. Store materials covered, out of direct sunlight, and at temperatures between 60 deg F and 70 deg F.

C. Dispose of empty containers by technicians in accordance with manufacturer's recommendations, current law, and industry standard practice.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not apply material when ambient or substrate temperature is 45 deg F or lower for 72 hours before, during, and for 24 hours after product application. Do not apply material when moisture due to dew, frost or water is present on substrate materials.

PART 2 - PRODUCTS

2.1 SPRAY POLYURETHANE FOAM (SPF) INSULATION

A. Closed-Cell Polyurethane Foam Insulation (SPF): ASTM C 1029, Type II, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84; with non-ozone depleting blowing agent. Coordinate catalysis with application temperature conditions.
   1. Density: ASTM D 1622; minimum density of 2.0 lb/cu. ft.
   2. Thermal Resistivity (R-Factor), LTTR: Not less than 6.4 per inch of thickness.
   3. Closed Cell Content: ASTM D 2856, 90 percent minimum.
   4. Vapor Permeance: ASTM E 96, 1-inch thickness, 1.2 perms maximum.
   5. Fungi Resistance: ASTM C 1338, no growth.
   6. Applied Thickness: Apply to provide a cured thickness as indicated. Where thickness is not indicated, provide a cured thickness of not less than 3 inches and not more than 4 inches.
   7. Products:
      a. JM Corbond III SPF; Johns Manville Corporation.
      b. CertaSpray Closed Cell Foam; CertainTeed Corporation.
      c. Heatlok Soy; Demilec LLC, Arlington, TX.
      d. Permax 2.0; Henry Company.
      e. Icynene MD-C-200; Icynene, Inc.
      f. Styrofoam SPF RS Series; Dow.

PART 3 - EXECUTION

3.1 PREPARATION

A. Mask and cover windows, doors, electrical boxes, and other items not indicated to receive insulation, protecting from fallout or overspray of materials during application.

B. Brush down framing, interior face of exterior sheathing, and adjacent substrates to loosen and remove cobwebs, dirt, dust and debris. Upon completion of operations, substrate shall be clean of substances that are harmful to insulation or that interfere with insulation attachment.

C. Maintain a minimum ambient and substrate temperature of 45 deg F for 72 hours prior to application of spray polyurethane foam insulation.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

D. Substrate Conditions: Using a thermal scan, verify that the temperature of the framing and sheathing substrates is 45 deg F or above. Record locations and temperatures of thermal readings. Do not apply insulation until substrates are at specified temperatures.

3.2 INSTALLATION OF SPRAY POLYURETHANE FOAM INSULATION

A. Coordination: Coordinate installation with sequence of construction to permit application of spray-applied insulation to location made inaccessible by enclosed construction.

B. Spray-Applied Insulation: Apply spray-applied insulation according to manufacturer's written instructions. Spray insulation to envelop entire area to be insulated and fill voids. Apply in consecutive passes as recommended by the manufacturer to achieve specified thickness.
   1. To prevent foam shrinkage and separation from exterior framing members, verify that proper catalyst is being used for temperature conditions. Maintain two part foam components at proper temperature in canisters and hose to nozzle tip.
   2. Apply foam at proper rate and thickness to assure foam does not overheat during curing.

3.3 CLEANING

A. Cleaning: Remove material overspray, and protection materials from surfaces of other construction and clean exposed surfaces. Remove trash and debris from the project site and properly dispose of.

END OF SECTION 072110

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

SECTION 072300 - UNDER-SLAB VAPOR RETARDERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Vapor retarder under slabs-on-grade.

B. Related Sections:
   1. Division 07 Section "Building Insulation" for vapor retarders installed on walls.
   2. Division 07 Section "Ethylene-Propylene-Diene-Monomer (EPDM) Roofing" for vapor retarder installed in conjunction with single ply roofing.

1.3 SUBMITTALS

A. General: Submit in accordance with Division 01 Section "Submittal Procedures."

B. Product Data: For each type of product indicated.

C. Samples for Verification: 12-inch square units for each type of vapor retarder, indicated.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect materials from physical damage and from deterioration. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Products: Subject to compliance with requirements, provide one of the products specified.

2.2 VAPOR RETARDERS FOR UNDER SLABS

A. Vapor Retarder: ASTM E-1745, meeting or exceeding Class B:
   1. Maximum Permeance: ASTM F 1249, not greater than 0.01 perms.
   2. Tensile Strength: ASTM E154 or D638, Class A - over 45 lbf/in.
   3. Puncture Resistance: ASTM E-154, Class B - over 1700 grams.
   4. Thickness of Barrier (Plastic) ACI 302.1R-96, not less than 15 mils.

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

5. Products:
   a. Stego Wrap;Stego Industries LLC.
   b. Vaporguard; Reef Industries.
   c. Sealtight Perminator Underslab Vapor-Mat; W.R. Meadows, Inc.
   d. VaporBlock VB15; Raven Industries.

B. Tape: High-density polyethylene tape with rubber-based pressure sensitive adhesive. Minimum 4-inch width. Provide cold weather tape for low temperature applications.

C. Perimeter Tape: StegoTack Tape, 2 inch wide double sided adhesive strip.

D. Mastic: Medium viscosity, polymer-modified anionic bituminous/asphalt emulsion.

E. Pipe Boot: Construct boots from vapor retarder material and high-density polyethylene tape per manufacturer's instruction.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for Sections in which substrates and related work are specified and other conditions affecting performance.
   1. Confirm granular base is level, properly rolled or tamped.
      a. Verify subgrade base tolerances before placement of vapor retarder. Base shall be flat to a tolerance of +1/4 inch an –3/4 inch. Shim granular base to tolerance of approximately ±1/4 inch. If significant final subgrade elevations need correction, provisions for proper compaction shall be made by the site work contractor.
   2. Confirm under slab insulation is in place with joints tight.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of substances harmful to vapor retarders, including removing projections capable of puncturing vapor retarders, or of interfering with attachment.

3.3 INSTALLATION, GENERAL

A. Comply with manufacturer's written instructions applicable to products and application indicated.

B. Extend vapor retarder in thickness indicated to envelop entire area to be covered. Cut and fit tightly around obstructions. Remove projections that interfere with placement.

3.4 INSTALLATION OF UNDER-SLAB VAPOR RETARDER

A. Moisture vapor retarder system shall be installed at all interior floor slabs on ground and as otherwise indicated in the drawings in strict accordance with the manufacturer's printed instructions and as follows:

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1. Underslab insulation shall be in place, ready to receive vapor retarder. Place vapor retarder on top of insulation.
2. Place vapor retarder with the longest dimension parallel with the direction of the pour.
3. Snap chalk line along inside perimeter of foundation walls at top of slab elevation.
4. Without wetting, clean a 3-inch wide band on the surface of the concrete below the chalk line at approximately mid-slab height. Remove dirt, residual form release, or other bond-inhibiting surface contaminates. Grind smooth any surface projections within band.
5. Lap vapor retarder on to perimeter foundation walls and vertical surfaces, sealing with continuous perimeter tape.
6. Lap joints 6 inches and seal with polyethylene tape.
7. Seal pipe penetrations with pipe boot made from vapor barrier and tape, or mastic per manufacturer's detail requirements.
8. Repair damaged areas by cutting patches of vapor retarder, overlapping damaged area 6 inches and taping all four sides with polyethylene tape.

3.5 PROTECTION

A. Protect installed vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where vapor retarders are subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 072300

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

SECTION 072500 - WEATHER BARRIERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Weather barrier/air barrier membrane.
   2. Flashings and sealants.
   3. Sill drainage pans.
   4. Installation of flashing membrane over window flange and tying into weather barrier system.

B. Related Sections:
   1. Division 06 Section "Rough Carpentry" for window rough openings to accommodate sill drainage pan.

1.3 SUBMITTALS

A. Complete Shop Drawings and Product Data shall be submitted to the Architect at least 21 days before the Preinstallation Conference. No Preinstallation Conference will be held and no material shall be applied until submittals are complete and released for construction.

B. Product Data: Submit manufacturer's current technical literature for each component. Include manufacturer's installation instructions and details showing the recommended procedures and sequence of installation of weather barrier.

C. Shop Drawings: Submit custom details for each condition specific to the project. Submit manufacturer installation details for terminations, perimeter edges, attachment and sealing to adjacent construction for the entire construction envelope, including the following:
   1. Termination and sealing at weather barrier perimeter edges.
   2. Flanged windows.
   3. Louvers.
   4. Door frames.
   5. Wall penetrations by pipes, ducts and conduits.
   6. Typical sheathing joint treatment, outside corner, inside corner where gaps occur.
   7. Detailing a penetration where sheathing has a wide gap from the penetration (Example: Large diameter oversized drilled hole receiving small conduit.)

D. Preinstallation Conference: Submit meeting minutes of preinstallation conference. Include coordination requirements with trades that interface with weather barrier.

E. Mockup Documentation: Submit photographic documentation of approved mockup installation and details.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

F. Manufacturer's Field Service Reports: Provide site reports from authorized field service representative, indicating observation of weather barrier assembly installation.

1.4 QUALITY ASSURANCE

A. Installer Qualifications:
   1. Installer shall have experience with installation of specified weather barrier assemblies under similar conditions.
   2. Installation shall be in accordance with weather barrier manufacturer's installation guidelines and recommendations.

B. Manufacturer's Field Service: Manufacturer's Representative shall be present at the following times for review of installations:
   1. Preinstallation conference.
   2. Commencement of Work: Manufacturer's Representative shall be present for the initial installation of the weather barrier, including flashing of typical openings and penetrations.
   3. Periodic Inspection: Manufacturer's Representative shall inspect entire weather barrier installation and prepare reports of observations of the completed installations, including completion of corrective measures identified during the installation review.

C. Source Limitations: Provide weather barrier and accessory materials produced by single manufacturer to ensure total system compatibility and integrity.

D. Mockup: Build mockup to set quality standards for materials and execution.
   1. Prepare mockups for review at Preinstallation Conference.
   2. Build mockup of weather barrier installation on typical exterior wall area in locations as directed by Architect.
   3. Install mockup using approved weather barrier assembly including fasteners, flashing, tape and related accessories per manufacturer's current printed instructions and recommendations. Include sample of flashing and sealing around openings and penetrations, window opening, and weather barrier perimeter.
   4. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups, unless such deviations are specifically approved by Architect in writing.
   5. Contact manufacturer's designated representative prior to weather barrier assembly installation, to perform required mockup visual inspection and analysis. Manufacturer's representative of the weather barrier shall be present for preparation of mockup.
   6. Approved mockup may become part of the work.

E. Preinstallation Conference: Conduct conference at Project site two weeks prior to start of weather barrier installation. Comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to roofing system including, but not limited to, the following:
   1. Complete Shop Drawings and Product Data shall be submitted to the Architect at least 21 days before the Preinstallation Conference.
   2. Meet with Owner, Architect, weather barrier Installer, weather barrier manufacturer's designated representative, sheathing Installer, and installers whose work interfaces with or affects weather barrier, wall cladding, trim, fdoors and flashings.

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

3. Review all related project requirements and submittals, status of substrate work and preparation, temporary weather protection, forecasted weather conditions, areas of potential conflict and interface, availability of weather barrier assembly materials and components, and coordinate methods, procedures and sequencing requirements for full and proper installation, integration ,repairs and protection.
4. Review approved submittals.
5. Review mock-up.
6. Review interface of flashings and trim with weather barrier system. Review requirements for stripping in tops of wall cap, window, and ledge flashings.
7. Review and coordinate sequence of installation with adjacent materials.
8. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.
9. Provide 7 business days minimum advance notice to participants prior to convening preinstallation conference.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver weather barrier materials and components in manufacturer's original, unopened, undamaged containers with identification labels intact.

B. Store weather barrier materials as recommended by weather barrier manufacturer.
1. Store roll materials vertically on end in original packaging. Maintain in a dry condition.
2. Protect rolls from direct sunlight and inclement weather until ready for use.
3. Store between 40 degrees and 90 degrees F.

1.6 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installing weather barrier only when existing and forecasted weather conditions will permit work to be performed according to manufacturers' recommendations and warranty requirements, and when substrate is completely dry. Weather barrier shall not be applied when ambient air and substrate temperatures are less than 20 deg F.

B. Substrate Conditions: Do not begin weather barrier installation until substrates have been inspected and are determined to be in satisfactory condition in accordance with manufacturer's requirements. All surfaces shall be sound, dry, even, and free of oil, grease, dirt, dust and other contaminants that are detrimental to the adhesion of the weather barrier membrane and flashing. No work shall proceed when moisture, ice or frost is present on the substrate materials.

1.7 SCHEDULING

A. Review requirements for sequencing of installation of weather barrier assembly with installation of windows, siding and trim, doors, and trim flashings to provide a weather-tight barrier assembly.
1. Contractor is solely responsible to make clear to Subcontractors the extent of their Work and coordinate overlapping Work to assure a weather tight building envelope.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

PART 2 - PRODUCTS

2.1 MATERIALS

A. Weather Barrier: WrapShield SA fully adhered water-resistive vapor permeable air barrier membrane system; VaproShield LLC; Gig Harbor, WA; Website: www.vaproshield.com.
   1. Local Representative: Bob McEachern, Roof Tech Sales LLC; phone: (603) 494-3757.
   2. Vapor-Permeable, Water-Resistive Barrier: Self-adhering, water-resistive, vapor-permeable, membrane consisting of multiple layers of UV stabilized spun-bonded polypropylene having the following properties:
      a. Air Leakage: Less than 0.01 cfm/ft. sq. in accordance with ASTM E 2357 and less than 0.0000263 cfm/sq. ft. at 75 Pa when tested in accordance with ASTM E 2178.
      b. Surface Burning Characteristics, ASTM E 84: Class A; Flame-spread index less than 10; Smoke-developed index less than 15.
      c. Water Vapor Permeance: ASTM E 96 Method B, 50 perms, minimum.
      d. Water Resistance: AATCC 127, 550 mm hydrostatic head for 5 hours, no leakage.
      e. Tensile Strength: ASTM D 882, 44.8 lbf/inch, machine direction; 25 lbf/inch, cross-machine direction.
      f. Thickness: 0.026 inches.
      g. Weight: 8.26 oz per sq. yd.

2.2 INSTALLATION ACCESSORIES

A. Transition and Flashing Membrane:
   1. Self-adhered weather barrier transition and flashing membrane shall be VaproShield VaproFlashing SA, zero VOC self-adhered water-resistive vapor permeable membrane.

B. Liquid Applied Flashing for Rough Openings: Liquid-applied, vapor permeable, weather barrier flashing for exterior openings with vapor permeance and resistance to air leakage properties compatible with the primary air barrier membrane.
   1. Product: VaproShield LLC; VaproLiqui-Flash.

C. Penetration Sealant: VaproShield LLC; VaproLiqui-Flash.

D. Weather Barrier Flashing Tapes: For use to secure weather barrier to itself and to substrates.
   1. Single-Sided Tape: VaproTape (Single-Sided), 20 mil thick, 3 inches wide.
   2. Flashing Tape: VaproFlashing SA.
   3. Double-Sided Sealing Tape: VaproTape (Double -Sided), 30 mil thick, 1 inch wide.
   4. UV-Resistant Tape: VaproTape, 35 mil thick by 4 inches wide penetration seam tape.
   5. Foil-Faced Tape: VaproAluma Tape, 20 mil thick by 4.5 inches and 9 inches wide, foil faced, UV stable, moisture-resistant flashing and membrane transition tape for use with silicone sealants.

E. Sill Drainage Pan Protection System: Extruded PVC sections with integral sloped shape with drainage ribs, preformed corner dams. Coordinate selection of sill pan depth with window unit frame size.
   1. Weather Out Flashing Products, WOF30 and WOF40 sill pan flashing.
   2. Joint Tape: Butyl flashing tape.
   3. Joint Sealant: Butyl sealant.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION

A. Examine substrates, areas, and surface conditions, with Installer present, to verify that surfaces are sound, dry, even, and free of oil, grease, dirt, dust and other contaminants that are detrimental to the adhesion of the weather barrier membrane and flashings, and for compliance with requirements and other conditions affecting performance of weather barrier.
   1. Sheathing: Verify that sheets are sufficiently attached with appropriate screws at proper spacing. Verify that fasteners are flush with sheathing.
   2. Fill voids and gaps in substrate greater than 1/4 inch in width to provide an even surface.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF WEATHER BARRIER SYSTEM

A. General: Install weather barrier over exterior face of exterior wall substrate in accordance with manufacturer's recommendations and instructions to provide a weather resistant barrier system.
   1. Apply materials within manufacturer's requirements for substrate and ambient temperatures and for weather conditions.
   2. Do not apply to wet or frozen (ice and frost) substrates.
   3. Install horizontally or vertically over the outside face of exterior sheathing. Horizontal joints shall be lapped in a weatherboard manner to shed water over membrane below.
   4. Complete detail Work around corners, wall openings, building transitions and penetrations prior to field applications.
   5. Install barrier sheet complete and continuous to substrate in a sequential overlapping weatherboard method starting at bottom or base of wall and working up and across.
   6. Stagger all end lap seams.
   7. Lap vertically a minimum of 6 inches and lap horizontally 3 inches. Do not place vertical laps above openings.
   8. Align and position self-adhered air barrier transition and flashing membrane, remove protective film and press firmly into place.
   9. Install membrane in tight intimate contact with substrate, without wrinkles and fishmouths. Lightly smooth out air bubbles with wallpaper brush.
   10. Roll entire surface of flexible flashing membrane firmly to assure positive contact and full adhesion to substrates.

B. Tie-in to building transition conditions and at the interface of dissimilar materials with barrier transition and flashing membrane, providing a permanent weather tight seal.

C. Window, Door and Other Wall Openings:
   1. Transition Membrane Installation:
      a. Wrap self-adhered barrier transition and flashing membrane into wall openings to cover sill, jambs and head.
      b. Remove release film, align flashing membrane and apply pressure to ensure positive contact. Roll Lap seams to ensure adhesion. Provide lap seams to shed water.
      c. Install preformed corner flashing membrane into corners over flashing membrane. Secure preformed corners into position with flashing tape and seal to weather barrier.

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

d. Install aluminized tape around perimeter of opening to accommodate placement of backer rod and sealant between frame and weather barrier membrane.

2. Liquid Applied Flashing System:
   a. Wrap self-adhered barrier transition and flashing membrane into wall openings to cover sill, jambs and head.
   b. Remove release film, align flashing membrane and apply pressure to ensure positive contact. Roll Lap seams to ensure adhesion. Provide lap seams to shed water.
   c. Apply liquid flashing material around perimeter of opening, and around inner perimeter surfaces of rough opening. Spread material with trowel around face of opening, creating a border approximately 2 inches wide. Spread material with trowel around inner perimeter surfaces of rough opening full depth of stud. Completely cover surfaces so substrate is not longer visible, approximately 12 to 15 mils WFT. Inside corners shall be filled. After material dries to the touch, inspect surfaces for voids and apply additional material required to achieve complete coverage.

D. Mechanical pipe, electrical conduit and similar penetration work shall be secured solid into position prior to installation of weather barrier membrane. Install penetration flashing and secure with tape in accordance with manufacturer's requirements.

E. At the tops of ledge flashing and cap flashings, seal watertight with 4 inch wide self-adhering transition membrane lapped over flashing shingle fashion. Trowel apply liquid flashing membrane along top of transition membrane to seal joint between weather barrier sheet and transition membrane.

3.3 TYING WINDOW FLANGE INTO WEATHER BARRIER SYSTEM

A. Clad Windows:
   1. Install sill drainage pans at window openings. Set lapped joint of corners and straight sill pan in continuous bead of butyl sealant, and tape over joints. Tie top and vertical flange of corner sill pans into weather barrier.
   2. After windows are installed, install flexible flashing membrane over head and jamb window flanges, butting to window frame and adhering flashing to weather barrier system to provide a water- and air-tight seal. Run a bead of penetration sealant around head and jambs to provide watertight seal between flashing membrane edge and window frame.

3.4 FIELD QUALITY CONTROL

A. Notify manufacturer's designated representative to obtain required periodic observations of weather barrier assembly installation. Completed weather barrier installation shall be viewed by manufacturer's authorized field service representative and the final field service report submitted to the Architect before the weather barrier system is covered by the wall cladding.

3.5 PROTECTION

A. Protect installed weather barrier from damage.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

B. Inspect exposed weather barrier just prior to installation of cladding. Remove water-resistive barrier materials that have been damaged and replace. Patch damaged areas as recommended by manufacturer.

END OF SECTION 072500

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

SECTION 074620 - FIBER-CEMENT SIDING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Fiber-cement siding.
2. Drainage mat.
3. Sealant in conjunction with siding.

B. Related Sections:
1. Division 06 Section "Rough Carpentry" for wall sheathing, and wood nailers, and blocking.
2. Division 06 Section "Finish Carpentry" for fiber-cement exterior trim and soffit materials; for vinyl soffits.
3. Division **0**7 Section "Weather Barriers" for air/water barrier and tying into windows and doors.
4. Division 07 Section "Joint Sealants."
5. Division 09 Section "Exterior Gypsum Sheathing" applied over entire exterior of building beneath weather barrier.
6. Division 9 Section "Painting" for field finishing of siding , soffits and trim over factory primer finish.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include the following:
1. Construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Preparation instructions and recommendations.
3. Installation methods, including fasteners and fastening patterns.
4. Storage and handling requirements and recommendations.
5. Submit manufacturer's fastener spacing and end distance requirements for each type and style of siding and accessories to resist a negative 37 psf wind pressure.

B. Samples: For siding, and related accessories including back flashing for siding joints, fasteners demonstrating size, color and texture.

C. Qualification Data: For qualified siding Installer.

D. Product Certificates: For each type of siding and panels, from manufacturer.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for fiber-cement siding.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

F. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

A. Labeling: Provide fiber-cement siding that is tested and labeled according to ASTM C 1186 by a qualified testing agency acceptable to authorities having jurisdiction.

B. Source Limitations: Obtain each type, color, texture, and pattern of siding and panels, including related accessories, from single source from single manufacturer.

C. Preinstallation Conference: Conduct conference at Project site. Meet with Architect, Installer, siding manufacturer representative, and installers of related Work. Record discussions and agreements and furnish copy to each participant. Provide at least 7 business days advance notice to participants prior to convening preinstallation conference.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver fiber-cement siding, panels, components, and other manufactured items so as not to be damaged or deformed. Package fiber-cement siding panels for protection during transportation and handling.

B. Store fiber-cement materials at site to prevent warping and weather damage, elevating above ground on level blocking and covering with colored tarp to prevent green-housing and water intrusion from top and sides but permitting adequate ventilation within bundles. Protect corners and edges from chipping.
   1. Deliver fiber-cement materials so as not to be damaged or deformed. Package fiber-cement materials for protection during transportation and handling.
   2. Store to protect it from becoming wet. If fiber-cement materials becomes wet, allow both faces, edges, ends and core to completely dry prior to installation. Failure to properly protect may result in the following:
      a. Swelling of the siding. If siding is installed while still wet, installed butt joints in siding will open once siding dries. Contractor shall replace prior to Substantial Completion.

C. Comply with manufacturer's recommendations for storage and handling of materials, including accessory products.

1.6 PROJECT CONDITIONS

A. Weather Limitations: Proceed with siding installation only when substrate is completely dry and when existing and forecasted weather conditions permit siding to be installed according to manufacturer's written instructions.

B. Substrate: Proceed with siding work only after substrate construction and penetrating work have been completed.

1.7 COORDINATION

A. Coordinate installation with flashings, trim and other adjoining construction to ensure proper sequencing.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1.8 WARRANTY

A. Special Warranty for Exterior Siding: Standard form in which manufacturer agrees to repair or replace factory primed siding that fail(s) in materials or workmanship within specified warranty period.
   1. Installer and Contractor shall comply with all requirements of manufacturer of fiber-cement siding manufacturer for obtaining of warranty, including documentation of installation and completion and forwarding of all necessary forms to fiber-cement siding manufacturer.
   2. Failures include, but are not limited to, the following:
      a. Structural failures including cracking and deforming.
   3. Warranty Period: As follows:
      a. Materials: 30 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 FIBER-CEMENT SIDING

A. General: ASTM C 1186, Type A, Grade II, fiber-cement board, noncombustible when tested according to ASTM E 136; with a flame-spread index of 25 or less when tested according to ASTM E 84; does not contain asbestos fibers; and has the following characteristics:
   1. Flexural Strength: ASTM C 1185, at least 1450 psi when in equilibrium condition, and at least 1015 psi when in wet condition.
   2. Coefficient of Thermal Expansion: ASTM E 228, less than 1 x 10^-5/inch/inch/degree F.
   3. Freeze Thaw Resistance: ASTM C 1185, at least 80 percent flexural strength retained.
   4. UV Resistance: ASTM G 26, no cracking, checking, or erosion, when tested for 2000 hours.
   5. Water Tightness: ASTM C 1185, no water droplets on underside.
   6. Manufacturer:
      a. Allura Fiber-Cement Siding, Plycem USA (formerly CertainTeed Corporation WeatherBoards).
      b. James Hardie.

B. Horizontal Lap Siding:
   1. Horizontal Pattern: Boards with plain edge style, 12 feet long.
      a. Pattern Size:
         1) Exterior Siding: 12 inches wide.
      b. Texture: Smooth.
      c. Exposure:
         1) Exterior Siding: 10-3/4~~5~~ inches.
      d. Finish:
         1) Exterior Siding: Factory primed.
   2. Product:
      a. Allura Fiber-Cement Siding, Plycem USA; Lap Siding.
      b. James Hardie, Hardiplank HZ5.

C. Siding Finish:
   1. Factory Priming: Manufacturer's standard acrylic primer.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

2.2 ACCESSORIES

A. Drainage Plane (Behind all siding locations):
   1. Drainage Mat: 0.024 inch thick high impact polystyrene sheets with micro perforations, formed into 1/8 inch corrugated drainage channels.
      a. Product: Masonry Technology, Inc.; Gravity Cavity Rainscreen Drainage Plane.
         1) Starter Sheet: 15-3/4 inches high by 76 foot long rolls with spunbond polypropylene fabric on one side with 4 inch skirt wrapped back under bottom to prevent insect intrusion.
            a) Gravity Cavity GC 1816.
         2) Field Sheet: 31-1/2 inches high by 76 foot long rolls without fabric.
            a) Gravity Cavity GC 1832NF.

B. Metal Flashing for Exterior Siding: Prefinished aluminum flashing, minimum 0.019-inch thick, with factory applied polyester finish to each face. Flashing shall be painted with two coats of acrylic latex paint to match siding colors. Provide as follows:
   1. Trim Cap Flashing: Horizontal joint flashing for siding. Preformed aluminum Z-shaped flashing butt joints of siding. Form shapes with metal break equipment, providing minimum of 8-foot lengths. Fabricate flashing to run back to weather barrier and turn up wall 2 inches minimum behind drainage mat. Install in full-length pieces without joints for locations less than the maximum available lengths. Seal lap joints with concealed bead of sealant.
      a. Flashing Tapes for Sealing Top of Metal Flashing to Weather Barrier: Pressure-sensitive, self-adhering, cold-applied, proprietary seam tape. Seam tape shall be from same manufacturer as weather barrier. Butyl flashing tapes are not acceptable.
         1) VaproShield LLC, VaproFlashing SA flashing tape shall be used in conjunction with the WrapShield SA weather barrier system, no substitution.
         2) Fluid Applied Flashing Sealant: VaproShield LLC; VaproLiqui-Flash liquid-applied flashing and joint sealant.
            a) Use for sealing across top edge and ends of flashing tape.
         3) Local VaproShield Representative: Bob McEachern, Roof Tech Sales LLC; phone: (603) 494-3757.

C. Back Flashing for Siding Joints: Tamlyn Extreme Trim, Plank Flash; 6 inches wide by height of siding minus 1/4-inch, fabricated .012 inch thick aluminum, paint coated on both sides, gray color. Felt paper or Bear Skin backer is not acceptable.

D. Individual Outside Corner Cover Trim: Tamlyn Fabricated Aluminum Trim OCI12W, smooth. individual outside corner pieces. Uniformly bend corner to corner shape at obtuse angled corners.
   1. Primer finish for field painting.

E. Fasteners for Siding:
   1. For fastening to wood, use corrosion-resistant, siding nails of sufficient length to penetrate a minimum of 1-1/4 inch into wood framing substrate.
   2. For fastening fiber cement, use stainless-steel fasteners.

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

F. Elastomeric Joint Sealant for Exterior Siding: 100 percent Acrylic latex joint sealant complying with ASTM C 920 and the requirements in Division 07 Section "Joint Sealants" for Use NT (nontraffic) and for Uses M, G, A, and, as applicable to joint substrates indicated, O joint substrates. Sealant shall be paintable.
   1. Provide sealant to match finish.
   2. Manufacturers of Color Matched Sealants:
      a. OSI Sealants, Inc.; Quad Advanced Formula Sealant for Windows, Doors & Siding.
      b. Franklin International; Titebond Weathermaster Sealant for Siding, Windows and Doors.
      c. Geocel Corporation; ProColor SWD Tripolymer Sealant.

2.3 FINISH FOR FIBER-CEMENT SIDING

A. Factory Sealer/Primer(: Fiber-cement siding shall have a coat of a factory-applied sealer/primer on front and all four sides, including butt ends, for field finishing.
   1. Primer/Sealer: Allura FiberTect or Hardie PrimePlus.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of siding and related accessories.

B. Verify that weather barrier installation is complete and has been approved to be concealed.

C. Verify window and door trim is installed, ready to receive siding and sealant.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 DRAINAGE PLANE INSTALLATION

A. Install drainage mat with corrugations vertical. Attach drainage mat to plywood sheathing with enough galvanized fasteners to hold drainage mat in place for siding installation.

B. At base of walls and above horizontal trim and window flashing starter sheet, back wrap fabric skirt at bottom edge to act as continuous bug screen.
   1. At base of walls, install continuous starter sheet behind siding starter strip to permit drainage at bottom of siding.
   2. At horizontal trim flashing and window flashing, install starter sheet for the full length of flashing run. Hold starter sheet approximately 1/2-inch above flashing. Do not allow starter strip to be exposed below siding. Siding shall be held 1/4-inch above flashing to permit drainage.

C. At top of siding runs at pent eave and parapet, terminate top of field sheets with continuous starter sheet installed inverted, back wrapping fabric skirt at top edge to act as continuous bug screen and permit venting. Hold sheet approximately 1/4-inch from blocking to permit venting.

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

Horizontal edge of siding shall run behind face trim 3/4-inch minimum, but stop short of blocking to permit venting. Do not caulk along horizontal edge.

D. Install field sheets over remainder of wall surfaces behind siding, providing a continuous drainage plane. Butt edges to vertical 5/4 trim.

3.3 INSTALLATION

A. General: Comply with siding manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply. Install starter strip as indicated and as recommended by manufacturer of siding system. Install siding with tolerances and fastener spacings as recommended by manufacturer, installing subsequent courses to form a weathertight surfacing.
   1. Do not install damaged components.
   2. Field cuts shall be sealed with one coat of primer before installing. Allow coating to dry before caulking.
      a. At edge along1/4-inch clearance between siding and horizontal flashing where siding edge will be left exposed to the weather, provide one coat of primer and two coats of finish before installing.
      b. Paint siding at outside corners receiving individual outside corner covers with one coat of paint finish and allow to dry before installing corners to prevent primer exposure from corner and siding movement.
   3. Provide minimum 6-inch clearance between bottom of siding and adjacent drives and finish grade.
   4. Provide minimum 2-inches clearance between bottom of siding and top of shingles at adjacent roof surfaces, patios, porches and other surfaces where water may collect. Provide minimum 1/4-inch clearance between siding and horizontal flashing.
   5. Allow uniform 1/8-inch gap where siding abuts trim, and from bottom of flashings. Use gauge block to assure proper spacing. Caulk joints, filling 1/8-inch wide joint to a depth of not less than 3/16-inch. Do not smear caulk on to face of siding. Do not tool sealant. Do not smear caulk on to face of siding. Provide smooth, crisp, uniform size sealant bead. Do not caulk 1/4-inch clearance between siding and horizontal flashing. Comply with installation requirements of Division 07 Section "Joint Sealants."
   6. Provide drip cap flashing over doors, windows, horizontal joints in panel siding and at horizontal trim to siding joints. Provide full-length pieces without lap splices to the maximum extent possible. For runs requiring splices, set vertical and horizontal legs of lap in sealant. Run flashing back to weather barrier, turn up 2 inches minimum and nail to wood sheathing at 12 inches on center with aluminum or stainless steel nails. Along top of flashing, apply a continuous strip of flashing tape, lapping onto sheathing weather barrier 3 inches minimum and over top of flashing and nails 1 inch. Roll surface of flashing tape with hard rubber roller to assure proper adhesion. Apply continuous bead of liquid applied flashing sealant across top of tape and trowel smooth.

B. Installation of Horizontal Lap Siding:
   1. Install horizontal siding in maximum available lengths; full length without butt joints where length required is less than 12 feet. Stagger end joints so that joints are separated horizontally a minimum of 3 feet and with at least three panels separation vertically. Lengths of installed siding shall not be less than 32 inches long. "Shorts" shall not be dispersed between full length siding runs.

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

2. Lap siding over lower course 1-1/4 inches and blind fasten through horizontal siding into wood sheathing, locating fasteners spaced 12 inches on center 1 inch down from top edge and no closer than 3/8-inch from the butt edge. Install exposed face fasteners spaced to align with blind fasteners. Do not over-drive fasteners; back of fastener head shall be flush with siding surface, not below siding surface. Fasten starting from one end and work across to the other. Locate butt joints to fall on studs. Butt joints against adjacent piece, with hairline seam. Each vertical butt joint shall be back-flashed with specified 6 inch wide by height of siding piece of metal flashing, installed shingle fashion to divert water onto lower course of siding.
3. Install individual outside corner covers at siding corners.

3.4 ADJUSTING AND CLEANING

A. Remove damaged, improperly installed, or otherwise defective materials and replace with new materials complying with specified requirements.

B. Clean finished surfaces according to manufacturer's written instructions.

END OF SECTION 074620

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

SECTION 075323 - ETHYLENE-PROPYLENE-DIENE-MONOMER (EPDM) ROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Adhered EPDM membrane roofing system.
2. Vapor retarder.
3. Roof insulation related to EPDM membrane roofing.
4. Roof accessories and walkway pads.

B. Related Sections:
1. Division 06 Section "Rough Carpentry" for wood nailers, curbs, and blocking.
2. Division 07 Section "Sheet Metal Flashing and Trim" for metal roof penetration flashings, roof edge flashings, and counterflashings.
3. Division 22 Sections for roof drains and gutter drains.

1.3 DEFINITIONS

A. Roofing Terminology: See ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definitions of terms related to roofing work in this Section.

B. Thermal Resistivity: Where the thermal resistivity of insulation products are designated by "r-values," they represent the reciprocal of thermal conductivity (k-values). Thermal conductivity is the rate of heat flow through a homogenous material exactly 1 inch thick. Thermal resistivities are expressed by the temperature difference in degrees F between the two exposed faces required to cause one BTU to flow through one square foot per hour at mean temperatures indicated.

1.4 PERFORMANCE REQUIREMENTS

A. General Performance: Installed membrane roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Membrane roofing and base flashings shall remain watertight.

B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by membrane roofing manufacturer based on testing and field experience.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

C. Roofing System Design: Provide membrane roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to ASCE/SEI 7.
   1. Corner Uplift Pressure: 70 lbf/sq. ft.
   2. Perimeter Uplift Pressure: 46 lbf/sq. ft.
   3. Field-of-Roof Uplift Pressure: 28 lbf/sq. ft.

D. Roof flashing details shall be consistent with those shown on Drawings. Where cap flashing is shown or specified, a standard manufacturer's bar anchor only detail is not acceptable. Membrane manufacturer's recommended flashing detail may be considered by the Architect when no detail is provided.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Provide installation instructions and general recommendations from manufacturer of EPDM membrane system for types of roofing materials required.

B. Shop Drawings: For roofing system approved by the manufacturer. Include plans, elevations, sections, details, and attachments to other work. Customized detail sheets shall be prepared by manufacturer, showing each condition and approved installation method conforming with construction drawing constraints and details.
   1. Base flashings and membrane terminations.
   2. Layout of tapered insulation, including slopes.
      a. Provide layout for total average thickness of roof insulation and tapered insulation over the entire roof to achieve an minimum R-49 value for the entire roof.
   3. Roof plan showing orientation of steel roof deck and orientation of membrane roofing and fastening spacings and patterns for mechanically fastened membrane roofing.
   4. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
   5. Roof flashing details shall be consistent with those shown on Drawings. Where cap flashing is shown, a standard manufacturer's bar anchor only detail is not acceptable. Membrane manufacturer's recommended flashing detail may be considered by the Architect when no detail is provided.

1.6 INFORMATIONAL SUBMITTALS

A. Installer Qualification Data: For qualified Installer signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install roofing system.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified, independent testing agency, for components of membrane roofing system.
   1. Insulation Test Reports: Include insulation test reports evidencing compliance with specified requirements including those for thermal resistance, fire-test-response characteristics, water-vapor transmission, water absorption, and other properties, based on comprehensive testing of current products.

C. Research/Evaluation Reports: For components of membrane roofing system, from the ICC-ES.

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

D. Inspection Report: Copy of roofing system manufacturer's inspection report of completed roofing installation.

E. Warranties: Sample of special warranties.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For membrane roofing system to include in maintenance manuals.

B. Warranties: Special warranties specified in this Section.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by membrane roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty. Contractor shall have a minimum of 5 years experience installing the system, have installed a minimum of 500,000 square feet and shall employ personnel experienced and skilled in the application of the manufacturer's roofing system.
   1. Work associated with membrane roofing including, but not limited to, insulation, flashing, and membrane sheet joint sealers, shall be performed by Installer of this Work.

B. Source Limitations: Obtain components including fasteners for membrane roofing system from same manufacturer as membrane roofing or approved by membrane roofing manufacturer.
   1. Insulation shall be by or approved by roofing manufacturer for use with roofing system for a total system warranty.

C. Exterior Fire-Test Exposure: ASTM E 108, Class A; for application and roof slopes indicated, as determined by testing identical membrane roofing materials by a qualified testing agency. Materials shall be identified with appropriate markings of applicable testing agency.

D. Insulation Fire Performance Characteristics: Provide insulation and related materials with the fire-test-response characteristics specified elsewhere in this Section as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
   1. Surface Burning Characteristic: ASTM E 84.
   2. Fire Resistance Ratings: ASTME E 119.
   3. Combustion Characteristics: ASTM E 136.

E. Fire-Resistance Ratings: Where indicated, provide fire-resistance-rated roof assemblies identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

F. Roofing work shall be applied in strict accordance with the provisions of the specification criteria. No deviations shall be permitted without written consent from the Architect. Should a conflict between this specification and the manufacturer's requirements arise, the most restrictive provision as determined by the Architect shall govern.

G. Upon completion of the installation, an inspection shall be made by the roofing system manufacturer to ascertain that the roofing system has been installed according to applicable manufacturer's specifications and details. No "early bird" warranty will be accepted. Results of

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

the warranty inspection shall be submitted in writing to Owner and Architect for their review and records.

H. Preinstallation Roofing Conference: Conduct conference at Project site. Review methods and procedures related to roofing system including, but not limited to, the following:
1. Meet with Architect, roofing Installer, roofing system manufacturer's representative, and installers whose work interfaces with or affects roofing, including installers of roof accessories, drains, roof-mounted equipment and skylights.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review protection of building occupants and air handlers from adhesive fumes during installation.
5. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
6. Review structural loading limitations of roof deck during and after roofing.
7. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
8. Review governing regulations and requirements for insurance and certificates if applicable.
9. Review temporary protection requirements for roofing system during and after installation.
    a. Review material placement, construction activity and pedestrian traffic protection requirements for work areas and access paths to areas where work will occur on completed membrane roofing.
10. Review roof observation and repair procedures after roofing installation. Establish monitoring procedures for construction activities and recording of damage by sub-trades.
11. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.
12. Provide 7 business days minimum advance notice to participants prior to convening preinstallation conference.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, shelf life, approval or listing agency markings, and directions for storing and mixing with other components. Comply with manufacturer's written instructions for proper material storage.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life. Replace discarded materials at no additional cost to Owner.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
1. Insulation board shall be stored on pallets, not less than 4 inches off ground, tightly covered with waterproof, "breathable" materials. Protect insulation from direct sunlight.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.
   1. Do not overload any portion of building, either by use of or placement of equipment, storage of debris, or storage of materials. Construction loads shall not exceed 25 pounds per square foot.

E. Weather protection shall mean the temporary protection of that work adversely affected by moisture, wind, heat, and cold by covering, patching and sealing, enclosing, ventilation, cooling and/or heat.

F. Do not overload any portion of the building either by use of or placement of equipment, storage of debris, or storage of materials. Construction loads shall not exceed 25 pounds per square foot.

G. Materials shall be delivered in sufficient quantity to allow continuity of Work.

H. Materials, which are damaged, shall be removed and replaced at Installer's expense.

1.10 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.
   1. Weather protection shall mean the temporary protection of that work adversely affected by moisture, wind, heat, and cold by covering, patching and sealing, enclosing, ventilation, cooling and/or heat.

B. Proceed with work so roofing materials are not subject to construction traffic. When construction traffic is necessary, roof sections shall be protected with plywood or other appropriate material to prevent damage; remove protection after construction traffic has ceased and re-inspected for possible damage.

C. Upon completion of sloped roof framing and roofing, EPDM membrane roofing shall be inspected for possible damage from installation of sloped roofing.

D. Substrate Conditions: Do not begin roofing installation until substrates have been inspected and are determined to be in satisfactory condition. All surfaces shall be smooth, dry, clean, free of fins or sharp edges, loose or foreign materials, oil or grease. No work shall proceed when moisture is present on roof or in substrate materials.

E. Temporary Waterstops: Install at end of each workday and remove before proceeding with next day's work.

F. Protect against fire and flame spread. Maintain proper and adequate fire extinguishers.

G. Take precautions to prevent drains from clogging during roofing application. Remove debris at completion of each day's work and clean drains, if required. At completion, test drains to ensure system is free running and drains are watertight. Remove strainers and plug drains in areas where work is in progress. Install flags or other telltales on plugs. Remove plugs each night and screen drain.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

H. Coordinate work with that of other trades effecting or effected by Work of this Section. Cooperate with such trades to ensure steady progress of all work under this contract.

1.11 WARRANTY

A. Special Warranty: Manufacturer's standard or customized form, without monetary limitation, in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within specified warranty period. Failure includes roof leaks. The maximum wind speed coverage shall be peak gusts of 72 mph measured at 10 meters above ground level. Warrantor shall be the manufacturer of the roofing membrane. Warranty shall be written to building Owner.
   1. Special warranty includes membrane roofing, base flashings, roof insulation, fasteners, roofing accessories, walkway products, and other components of membrane roofing system.
   2. Warranty Period: 20 years from date of Substantial Completion.

B. When the Warrantor is notified that there is a problem (leak or damage) with warranted roofing system and/or accessories by telephone, and/or in writing (fax, e-mail or mail), the response time to physically start repairs shall be within twenty-four hours from time of telephone or date of written notification.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
   1. Products: Subject to compliance with requirements, provide one of the products specified.
   2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 EPDM MEMBRANE ROOFING

A. EPDM: ASTM D 4637, Type I, non-reinforced, uniform, flexible EPDM sheet.
   1. Manufacturers:
      a. Carlisle SynTec Incorporated.
      b. Firestone Building Products.
      c. Versico Incorporated.
      d. Johns Manville.
   2. Thickness: 90 mils.
   3. Exposed Face Color: Black.

2.3 AUXILIARY MEMBRANE ROOFING MATERIALS

A. General: Auxiliary membrane roofing materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing.
   1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

B. Sheet Flashing: 60-mil- thick EPDM, partially cured or cured, according to application.

C. Seaming Material: Manufacturer's standard splice tape for sealing lapped joints, including edge sealer to cover exposed spliced edges as recommended by membrane manufacturer.

D. Lap Sealant: Manufacturer's standard, single-component sealant.

E. Membrane Bonding Adhesive: As recommended by membrane manufacturer for particular substrate and project conditions, formulated to withstand specified uplift force.

F. Water Cutoff Mastic: Manufacturer's standard butyl mastic sealant.

G. Metal Termination Bars: Manufacturer's standard, predrilled stainless steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.

H. Crickets and Flashing Accessories: Types recommended by membrane manufacturer, including adhesive tapes, flashing cements, and sealants.
1. Crickets: Tapered crickets, extending to roof drain sumps, 1/2-inch taper.

I. Fasteners: Factory-coated steel or stainless steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening membrane to substrate, and acceptable to roofing system manufacturer.

J. Pipe Flashing: Provide membrane manufacturer's standard pre-molded flashing boot for flashing around pipe and conduit roof penetrations. Provide cone shaped flashing boot, heat welded to membrane with stainless steel clamping ring.
1. Field-formed pipe flashing not allowed.

K. Miscellaneous Accessories: Provide preformed cone flashings, preformed inside and outside corner sheet flashings, reinforced EPDM securement strips, T-joint covers, in-seam sealants, termination reglets, cover strips, and other accessories.
1. Pourable sealers not allowed.

L. Roof Walkways: Shall be premolded rubber walkways supplied by membrane manufacturer.

M. Expansion Joint Bulb: Preformed, compressible, resilient, nonstaining, nonwaxing, nonextruding strips of flexible, closed-cell polyethylene foam, nonabsorbent to liquid water and gas; size as needed to meet expansion joint conditions.

N. Miscellaneous Accessories: Provide preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, termination reglets, cover strips, and other accessories.

2.4 VAPOR RETARDER

A. Reinforced-Polyethylene Vapor Retarders: Two outer layers of polyethylene film for 8 mil thickness, laminated to an inner reinforcing layer consisting of either nylon cord or polyester scrim and weighing not less than 40 lb/1000 sq. ft., with maximum permeance rating of 0.066 perm.
1. Products:
a. Raven Industries Inc.; DURA-SKRIM 8WB.
b. Reef Industries, Inc.; Griffolyn T-65.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

B. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

C. Perimeter Sealant: Butyl sealant.

2.5 ROOF INSULATION

A. General: Preformed roof insulation boards manufactured or approved by EPDM membrane roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated.

B. Polyisocyanurate Board Insulation: ASTM C 1289-13e1, Type II, Class 1, Grade 2 (20 psi), glass-fiber mat facer on both major surfaces.
1. Insulation LTTR-Values: Not less than R-5.6 per inch.
2. Thickness: 2 equal layers of insulation for a total thickness indicated.
3. Products:
   a. Carlisle SynTec Inc.; Polyiso HP-H.
   b. Dow Chemical Co.; Hy-Therm AP.
   c. Firestone Building Products Co.; ISO 95+.
   d. Johns Manville International, Inc.; E'nrg'y 3.
4. Provide roofing manufacturer's required insulation for total system warranty.

C. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches, unless otherwise indicated. ASTM C 1289, Type II, Class I, Grade 2 (20 psi), glass-fiber mat facer on both major surfaces.
1. Tapered insulation shall meet requirements specified for board roof insulation. Provide tapered boards where indicated.
2. Tapered insulation at roof drains shall slope 1/2 inch per 12 inches, unless otherwise indicated.
3. Tapered insulation shall be manufactured by same manufacturer of board roof insulation.

D. Provide preformed crickets, tapered edge strips, and other insulation shapes where required for sloping to drain. Fabricate to slopes indicated.

2.6 INSULATION ACCESSORIES

A. General: Furnish roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with membrane roofing.

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.

C. Insulation Adhesive for Cover Board installation: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer as follows:
1. Full-spread spray-applied, low-rise, two-component urethane adhesive.

D. Cover Board: High-density, closed-cell polyisocyanurate foam core laminated to glass-mat, water-resistant facer; 1/2-inch thick unless indicated otherwise.
1. Compressive Strength: ASTM D 1621, minimum 100 psi.
2. Water Absorption: ASTM C 209, less than 3 percent volume.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

3. Products:
   a. Carlisle SynTec Incorporated; Securshield HD Cover Board Insulation.
   b. Firestone Building Products Company; Isogard HD.
   c. Versico Roofing Systems; Securshield HD Cover Board Insulation.
   d. Johns Manville; Invinsa Roof Board, 1/4-inch thick, 150 PSI.

2.7 WALKWAYS

A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, solid-rubber, slip-resisting, surface-textured walkway pads or rolls, approximately 3/16 inch thick, and acceptable to membrane roofing system manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:
   1. Verify that roof openings and penetrations are in place and curbs are set and braced and that roof drain bodies are securely clamped in place.
   2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
   3. Examine roof sheathing to verify that sheathing joints are supported by framing and blocking; that installation is within flatness tolerances; and that fastening complies with requirements of UL assemblies.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with manufacturer's instructions for preparing substrate to receive EPDM membrane roof system.

B. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.

C. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

D. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

3.3 VAPOR-RETARDER INSTALLATION

A. Reinforced Polyethylene Film: Loosely lay polyethylene-film vapor retarder in a single layer over area to receive vapor retarder, side and end lapping each sheet a minimum of 2 inches and 6 inches, respectively.
   1. Continuously seal side and end laps with tape.

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

B. Completely seal vapor retarder, setting sheet in continuous bead of butyl sealant at terminations, obstructions, and penetrations to prevent air movement into membrane roofing system.

3.4 INSULATION INSTALLATION

A. Coordinate installing membrane roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with membrane roofing system and insulation manufacturer's written instructions for installing roof insulation.

C. Install tapered insulation under area of roofing to conform to slopes indicated, or if not indicated, as required for positive drainage to roof drains.

D. Install insulation in two layers under area of roofing to achieve required thickness. Install layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 12 inches in each direction with no gaps, to form a complete thermal envelope.
1. Taper insulation around roof drains, providing 4-foot square sump.
2. Install tapered insulation and crickets to provide positive slope to drains without ponding of water.
3. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.

E. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.

F. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch with insulation.

G. Mechanically Fastened Insulation: Install each layer of insulation and tapered insulation and secure to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.
1. Fasten insulation to resist uplift pressure at corners, perimeter, and field of roof as determined in accordance with ASCE 7, but in no case, provide less than one anchor per 4 sq. ft. of surface area (8 fasteners per 4 x 8 foot board).
   a. In no case shall there be less than 2 fasteners per piece of insulation.
2. Screws shall be installed utilizing automatic, positive clutch disengaged and adjustable nosepiece.
3. Tapered insulation shall be mechanically attached using same procedures noted above.
4. Install tapered edge strips at edges of tapered insulation to provide smooth transition to flat areas, free of gaps and voids.

H. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches in each direction. Loosely butt cover boards together adhere to substrate.
1. Adhesively attach cover boards to resist uplift pressure at corners, perimeter, and field of roof.

I. Do not install more insulation in a day than can be covered with membrane before end of day or before start of inclement weather.

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

3.5 ADHERED MEMBRANE ROOFING INSTALLATION

A. Adhere membrane roofing over area to receive roofing according to membrane roofing system manufacturer's written instructions and approved Shop Drawings. Unroll membrane roofing without stretching and allow to relax before installing.

B. Start installation of membrane roofing in presence of membrane roofing system manufacturer's technical personnel.

C. Fully Adhered Membrane: Install membrane by unrolling over prepared substrate, lapping adjoining sheets as recommended by manufacturer. Apply adhesive to surfaces to be bonded and roll into place when adhesive has properly cured. Clean and prime both faces of splice areas, apply splice tape, and firmly roll side and end laps of overlapping membrane roofing according to manufacturer's written instructions to ensure a watertight seam installation.
   1. Accurately align roofing membrane and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps. Position sheets to accommodate contours of roof deck to avoid bucking water.
   2. Apply roofing membrane with side laps shingled with slope of roof deck where possible.
   3. Flashing details shall be done in accordance with the approved shop drawings. Base flashing shall be properly terminated and covered with counterflashing, providing not less than a 4-inch overlap.
   4. Apply 6-inch wide strip of uncured EPDM to all field sheet seams, which will underlie walkway.

D. In addition to adhering, mechanically fasten membrane roofing securely into wood blocking, at terminations, penetrations, and perimeters as required by roof conditions.

E. Repair tears, voids, and lapped seams in roofing that does not comply with requirements.

F. Perimeter membrane shall extend down wall at least 1 inch past bottom of the wood nailer, lapping over the wall finish, but not exposed below the flashing.

G. Flashing details shall be done in accordance with the approved Shop Drawings. Base flashing shall be properly terminated and covered with counterflashing, providing not less than a 4-inch overlap.

H. Cut out and repair membrane defects at the end of each day's work.

3.6 BASE FLASHING INSTALLATION

A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions and approved Shop Drawings.

B. Flashing of parapets, curbs, expansion joints, and other parts of the roof shall be performed using EPDM membrane flashing.

C. At roof edges, flashing shall run under metal coping and flashing full length and width. Membrane shall extend down wall at least 1-inch past bottom of wood nailer, lapping over wall finish, but not exposed below the flashing.

D. Flash all projections including pipes, conduits, and curbs passing through the membrane.

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1. Flash pipes and conduits with pre-molded cone type flashing boots. Do not field fabricate pipe flashing.

E. Base Flashing: Tops of elastomeric base flashing shall be secured with a continuous aluminum termination bar, sealed and counterflashed.

F. Vertical flashings and membranes shall be adhered to substrates regardless of height.

G. Apply bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply to seam area of flashing.
1. Keep exposed surface of EPDM free of adhesive.

H. Flash penetrations and field-formed inside and outside corners with sheet flashing conforming to manufacturer's requirements. Provide a minimum overlap of 3-inches.

I. Clean splice areas, apply splicing cement, and firmly roll side and end laps of overlapping sheets to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of sheet flashing terminations.
1. Keep exposed surface of EPDM free of adhesive.

J. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.7 WALKWAY INSTALLATION

A. Rubber Roof-Paver Walkways: Install walkway roof pavers according to manufacturer's written instructions in locations indicated, to form walkways. Install roof-paver walkways at all traffic concentration points (such as roof hatches, access doors, rooftop ladders, around mechanical equipment, etc.); all locations as identified on the Drawings; and all locations required by manufacturer for obtaining warranty. Leave 3 inches of space between adjacent roof pavers as required by manufacturer to per proper drainage.

3.8 ROOF DRAIN INSTALLATION

A. Roof Drain System: Install roof drain and accessories in strict accordance with manufacturer’s written instructions, providing a permanent weather tight installation.
1. Inspect and determine substrate to be in satisfactory condition, with deck fully anchored and aligned at proper location and elevation. All surfaces shall be smooth, dry, clean, free of sharp edges, and other irregularities.
2. Attach deck flange securely to substrate.
3. Assemble and flash gravel stop flange into roof system per roof system and roof drain manufacturer requirements.
4. Securely attach strainer basket.

3.9 FIELD QUALITY CONTROL

A. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion and submit report to Architect.
1. Notify Architect or Owner 5 business days in advance of date and time of inspection.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

B. Repair or remove and replace components of membrane roofing system where inspections indicate that they do not comply with specified requirements.

C. Additional inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.10 PROTECTING AND CLEANING

A. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.
   1. Coordinate material placement, construction activity and pedestrian traffic protection requirements for work areas and access paths to areas where work will occur on completed roofing.

B. Correct deficiencies in or remove membrane roofing system that does not comply with requirements, repair substrates and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 075323

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following sheet metal flashing and trim:
   1. Manufactured roof edge flashings.
   2. Formed low-slope roof flashing and trim.
   3. Formed counterflashing and base flashing.
   4. Ledge flashing.
   5. Trim.
   6. Miscellaneous sheet metal accessories.
   7. Manufactured gutter system.

B. Related Sections include the following:
   1. Division 04 Section "Unit Masonry Assemblies" for metal wall flashing in conjunction with brick veneer.
   2. Division 06 Section "Rough Carpentry" for wood nailers, curbs, and blocking.
   3. Division 06 Section "Finish Carpentry" for installation of Z-cap flashing in conjunction exterior trim.
   4. Division 07 Section "Weather Barrier" for tying flashings into weather barrier.
   5. Division 07 Sections "Fiber-Cement Siding" for Z-cap flashing and for installation of receiver portion of two-piece counterflashing in conjunction with siding.
   6. Division 07 Section "Ethylene-Propylene-Diene-Monomer (EPDM) Roofing" for installing sheet metal flashing and trim integral with roofing membrane.

1.3 PERFORMANCE REQUIREMENTS

A. General: Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing, rattling, leaking, and fastener disengagement.

B. SPRI Wind Design Standard for Manufactured Roof Edge Flashings: Manufacture and install roof-edge flashings tested according to SPRI ES-1 and capable of resisting the following design pressures:
   1. Design Wind Uplift:
      a. Corner Uplift Pressure: 70 lbf/sq. ft.
      b. Perimeter Uplift Pressure: 46 lbf/sq. ft.

C. Thermal Movements: Provide sheet metal flashing and trim that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

rotation and avoid shear stress as a result of sheet metal and trim thermal movements. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

D. Water Infiltration: Provide sheet metal flashing and trim that do not allow water infiltration to building interior.

1.4 SUBMITTALS

A. General: Submit in accordance with Division 01 Section "Submittal Procedures."

B. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, finishes, and installation instructions.

C. Shop Drawings: Show layouts of sheet metal flashing and trim, including plans and elevations. Distinguish between shop- and field-assembled work. Provide layouts at 1/4-inch scale and details at 3-inch scale. Include the following:

1. Identify material, thickness, weight, and finish for each item and location in Project.
2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
3. Details for fastening, joining, supporting, and anchoring sheet metal flashing and trim, including fasteners, clips, cleats, and attachments to adjoining work.
4. Details of connections to adjoining work.

D. Samples for Initial Selection: For each type of sheet metal flashing and trim indicated with factory-applied color finishes.

1. Include similar Samples of trim and accessories involving color selection.

E. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:

1. Sheet Metal Flashing: 12 inches long. Include fasteners, cleats, clips, closures, and other attachments.

F. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

G. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has completed sheet metal flashing and trim work similar in material, design, forming method, and extent to that indicated for this Project and with a record of successful in-service performance for ten years.

B. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual, Seventh Edition." Conform to dimensions and profiles shown unless more stringent requirements are indicated.

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."
   1. Meet with Owner, Architect, Installer, and installers whose work interfaces with or affects sheet metal flashing and trim including installers of roofing materials, roof accessories, and roof-mounted equipment.
   2. Review methods and procedures related to sheet metal flashing and trim.
   3. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
   4. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.
   5. Provide not less than 7 business days advance notice to participants prior to convening preinstallation conference.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver sheet metal flashing materials and fabrications undamaged. Protect sheet metal flashing and trim materials and fabrications during transportation and handling.

B. Unload, store, and install sheet metal flashing materials and fabrications in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack materials on platforms or pallets, covered with suitable weathertight and ventilated covering. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.
   1. Store tin-zinc alloy coated copper away from uncured concrete and masonry.

1.7 COORDINATION

A. Coordinate installation of sheet metal flashing and trim with interfacing and adjoining construction to provide a leakproof, secure, and noncorrosive installation.

B. Coordinate Work of this Section with interfacing and adjoining Work for proper sequencing of each installation to ensure a weathertight installation.

1.8 WARRANTY

A. General: Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Special Warranty on Painted Finishes for Manufactured Roof Edge Flashings and Prefinished Sheet Metal: Manufacturer's standard form in which manufacturer of agrees to repair finish or replace manufactured roof edge flashings that show evidence of deterioration of factory-applied finishes within specified warranty period.
   1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
      a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
      b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
      c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
   2. Finish Warranty Period on Manufactured Roof Edge Trim/Fascia Units: Manufacturer's standard, but not less than 10 years from date of Substantial Completion.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

C. Special Installer's Warranty: Installer's warranty, on warranty form at end of this Section, signed by Installer, in which Installer agrees to repair or replace components of custom-fabricated sheet metal flashing and trim that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures.
      b. Loose parts.
      c. Wrinkling or buckling.
      d. Failure to remain weathertight, including uncontrolled water leakage.
   2. Warranty Period: Two years for date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Products: Subject to compliance with requirements, provide one of the products specified.

2.2 SHEET METALS

A. Copper Sheet: ASTM B 370, Temper H00 or H01, cold-rolled copper sheet.

B. Aluminum Sheet: ASTM B 209, Alloy 3003, 3004, 3105, or 5005, Temper suitable for forming and structural performance required, but not less than H14, finished as follows:
   1. High-Performance Organic Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
      a. Fluoropolymer 2-Coat System: Manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2605.
      b. Colors: As selected by Architect from manufacturer's full range of colors.
         1) Provide not less than 4 gray colors in various shades from light gray to charcoal.

C. Prepainted, Metallic-Coated Steel Sheet: Steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
   1. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, Class AZ50 coating designation, Grade 40; structural quality.
   2. Exposed Finishes: Apply the following coil coating:
      a. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
         1) Fluoropolymer 2-Coat System: Manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with physical properties and coating performance requirements of AAMA 2605, except as modified below:

a) Humidity Resistance: 2000 hours.
b) Salt-Spray Resistance: 2000 hours.

2) Color: As selected by Architect from manufacturer's full range.

2.3 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads.

1. Nails for Copper Sheet: Copper or hardware bronze, 0.109 inch minimum and not less than 7/8 inch long, barbed with large head.
2. Exposed Fasteners: Heads matching color of sheet metal by means of plastic caps or factory-applied coating.
3. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws, gasketed, with hex washer head.
4. Blind Fasteners: High-strength aluminum or stainless-steel rivets.

C. Solder for Copper: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead.

D. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.

E. Elastomeric Sealant: ASTM C 920, elastomeric polymer sealant; of type, grade, class, and use classifications recommended by manufacturer of metal and fabricator of components and complying with requirements to seal joints in sheet metal flashing and trim and remain watertight.

F. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant, polyisobutylene plasticized, heavy bodied for hooked-type expansion joints with limited movement.

G. Mastic Sealant: Polyisobutylene; nonhardening, nonskinning, non- drying, nonmigrating sealant.

H. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

I. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

J. Metal Accessories: Provide sheet metal clips, straps, anchoring devices, and similar accessory units as required for installation of work, matching or compatible with material being installed, noncorrosive, size and gage as required for performance.

K. Elastic Flashing Filler: Closed cell polyethylene or other soft closed cell material recommended by elastic flashing manufacturer as fill under flashing loops to ensure movement with minimum stress on flashing sheet.

L. EPDM Flashing Membrane: 0.060 inch thick uncured EPDM flashing membrane.

M. Flashing Tapes for Sealing Top of Metal Flashing to Weather Barrier: Pressure-sensitive, self-adhering, cold-applied, proprietary seam tape. Seam tape shall be from same manufacturer as weather barrier. Butyl flashing tapes are not acceptable.
1. VaproShield LLC, VaproFlashing SA flashing tape shall be used in conjunction with the WrapShield SA weather barrier system, no substitution.
2. Fluid Applied Flashing Sealant: VaproShield LLC; VaproLiqui-Flash liquid-applied flashing and joint sealant.
a. Use for sealing across top edge and ends of flashing tape.
3. Local VaproShield Representative: Bob McEachern, Roof Tech Sales LLC; phone: (603) 494-3757.

2.4 MANUFACTURED ROOF EDGE FLASHINGS

A. Manufactured roof edge flashings specified in this article and manufactured roof drainage system specified in the following article shall be manufactured by the same manufacturer.

B. Roof-Edge Fascia: Manufactured two-piece, roof-edge fascia consisting of snap-on metal fascia cover in section lengths not exceeding 12 feet**;** a continuous extruded aluminum bar with integral drip-edge to engage fascia cover and secure single-ply roof membrane; and necessary splice plates. Provide matching factory-mitered and welded corner units.
1. Performance: Per IBC 2009 low-slope membrane roof system metal edge securement shall be designed and installed for wind loads and tested in accordance with ANSI/SPRI ES-1.
2. Face Height: 4 inches unless indicated otherwise.
3. Fascia Cover Material: Fabricate from prefinished, sheet aluminum, not less than 0.040 inch thick.
a. Color: As selected by Architect from manufacturer's full range of options.
1) Provide not less than 4 gray colors in various shades from light gray to charcoal.
4. Product: Anchor-Tite Standard Fascia by Metal-Era, Inc.

2.5 MANUFACTURED DRAINAGE GUTTER SYSTEM

A. Manufactured roof drainage system specified in this article and manufactured roof edge flashings specified in the article above shall be manufactured by the same manufacturer.

B. Gutters: Heavy-duty commercial gutter manufactured in uniform section lengths not exceeding 12 feet, with matching factory-mitered, welded corner units, ends, outlet tubes, and other accessories. Elevate back edge at least 1 inch above front edge. Furnish flat-stock gutter straps, expansion joints, and expansion-joint covers fabricated from same metal and finish as gutters.
1. Material: Fabricate from prefinished, sheet aluminum, not less than 0.050 inch thick.

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

a. Color: As selected by Architect from manufacturer's full range of options to match trim.

2. Face Height: 4-1/2 inches.
3. Accessories: Support bracket fabricated from 0.100 inch thick aluminum gutter straps, with prepunched holes, and finished to match gutter.
4. Product: Seal-Tite Industrial Gutter, IGB-C6 Version by Metal-Era, Inc.

C. Downspouts: Heavy-duty commercial downspouts, rectangular configuration complete with mitered elbows, manufactured from the following exposed metal. Furnish with aluminum support hangers, same finish as downspouts, and anchors.

1. Material: Fabricate from prefinished, sheet aluminum, not less than 0.050 inch thick.
   a. Color: As selected by Architect from manufacturer's full range of options to match trim.
2. Size, not less than 3 by 4 inches. Provide open face downspout at straight drops.
   a. Provide downspout adapters for connection to below grade drain piping.
3. Product: Seal-Tite Industrial Downspout by Metal-Era, Inc.

2.6 CUSTOM FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual, Seventh Edition" that apply to design, dimensions, metal, and other characteristics of item indicated. Shop fabricate items where practicable. Obtain field measurements for accurate fit before shop fabrication.

B. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.

C. Fabricate sheet metal flashing and trim in minimum 96-inch- lengths, but not exceeding 10-foot- long sections.

D. Fabricate sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.

1. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.

E. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA recommendations.

F. Expansion Provisions: Where lapped or bayonet-type expansion provisions in the Work cannot be used or would not be sufficiently water/weatherproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with elastomeric sealant concealed within joints.

G. Separations: Provide for separation of metal from noncompatible metal or corrosive substrates by coating concealed surfaces at locations of contact, with bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or other permanent separation as recommended by manufacturer/fabricator.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

H. Conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherwise indicated.

I. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
   1. Thickness: As recommended by SMACNA's "Architectural Sheet Metal Manual" for application but not less than thickness of metal being secured.

2.7 CUSTOM FABRICATED FLASHING SCHEDULE

A. Counter Flashing for Membrane Flashing at Fiber-Cement Siding (Above entrance canopies and Integral Gutter): SMACNA, Figure 4.4C (modified); turn vertical leg up 6 inches; 12-inch wide L-shaped plates for receiver joints. Fabricated from 0.040 prefinished, aluminum sheet in color selected by Architect. Furnish receiver flashing and back-up plates to installers of fiber-cement siding for installation into their siding work.

B. Two-Piece Counter Flashing for Membrane Flashing at Masonry: SMACNA, Figure 4.4C (modified); turn vertical leg up 6 inches; make horizontal leg run back to wall sheathing; 12-inch wide L-shaped back-up plates for receiver joints, 16 oz. copper receiver; 20 oz. copper insert flashing. Furnish receiver flashing and back-up plates to mason for installation into brickwork.

C. Sloped Termination Brick Flashing: L-shaped flashing; 2 inch horizontal leg with hemmed edge; 6 inch high vertical leg; fabricated from 0.040 prefinished aluminum in color selected by Architect.
   1. Set horizontal leg in bed of butyl sealant to seal between brick and flashing. Hemmed edge of horizontal leg to be in tight contact with brick.

D. Entrance Canopies:
   1. Roof Edge Strip: SMACNA, Figure 2.5C modified with no edge kick; continuous edge clip; 6-inch flange on roof; Fabricate from 16 ounce copper.
   2. Fascia: Fabricate to configuration indicated. Full length pieces length of run to maximum extent possible. Continuous concealed clips.

E. Door and Window Head Flashing: Z-flashing with exposed edge hemmed; prefinished 0.032 aluminum; Black color; turn vertical leg up wall 4 inches; one piece, full width of opening to the maximum extent possible.

F. Balcony Deck Door Sill Pans: Continuous, one piece sill pan full width of door rough opening; Back and pans up tight to back of door sills; Turn ends of pans up and solder inside corners; Outside edge of pan edge to turn down over balcony base flashing; ends of pans to lap out on to face of walls with bottom face corners soldered; Fabricate from 16 ounce copper.

G. Louver Sill Flashing and Miscellaneous Metal Flashing at Brick: Shop formed to detail, continuous clips; fabricated from prefinished aluminum-zinc alloy-coated sheet steel, minimum 24 gage thickness; color selected by Architect.

H. Roof Edge Strip for Single Ply Membrane Roofing (Decks): SMACNA, Figure 2.5C modified with no edge kick; continuous edge clip; 6-inch flange on roof; Fabricated from prefinished, prefinished metallic coated steel sheet not less than 0.028 inch thick, 24 gage.

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

I. Miscellaneous Flashing at Masonry: Formed to required detail; not less than 16 oz. copper.

J. Miscellaneous Flashing at Siding: Formed to required detail; fabricated from 0.040 prefinished aluminum in color selected by Architect.

2.8 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of work.
1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
1. Torch cutting of sheet metal flashing and trim is not permitted.

B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by fabricator or manufacturers of dissimilar metals.
1. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene underlayment.
2. Bed flanges in thick coat of water cutoff mastic where required for waterproof performance.

C. Install sheet metal flashing and trim with minimum number of joints practical, using manufactured or shop fabricated full-length pieces. Provide one piece flashing and trim using full-length pieces without joints where run is less than the 8 to 10 foot fabricated lengths. Do not use pieces less than 24 inches long.

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1. Sill Flashing at Openings: Provide one piece flashing, full width of opening except where opening exceeds available manufactured/fabricated lengths. Provide sealed metal end dams at ends of sills. Sills flashing shall turn up on back side to form pan, directing water to the exterior.

D. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.

E. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and elastomeric sealant.

F. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
1. Cleats shall be continuous, unless otherwise noted.

G. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with elastomeric sealant concealed within joints.

H. Fasteners: Use fasteners of sizes that will penetrate substrate not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.
1. Prepainted, Metallic-Coated Steel: Use stainless-steel fasteners.
2. Aluminum: Use stainless-steel fasteners.
3. Copper: Use copper or stainless steel fasteners.

I. Seal joints with elastomeric sealant as required for watertight construction.
1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F, set joint members for 50 percent movement either way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.
2. Prepare joints and apply sealants to comply with installation requirements in Division 07 Section "Joint Sealants."

J. Top of Flashing to Weather Barrier: At the top of metal flashings, nail through weather barrier and gypsum sheathing to wood sheathing at 8 inches on center with stainless steel nails, drawing flashing in tight contact with sheathing, Locate nails near top edge so they are covered with flashing tape. Coordinate installation of flashing with installer of the weather/air barrier. Along top of flashing, apply a continuous strip of flashing tape, lapping onto sheathing weather barrier 6 inches minimum and over top of flashing and nails 3 inches minimum. Roll surface of flashing tape with hard rubber roller to assure proper adhesion. Apply continuous bead of liquid applied flashing sealant across top of tape and trowel smooth. Initial flashing installation and periodic checks with the weather barrier tie in shall be inspected and approved by the weather barrier manufacturer's designated representative before hidden by the masonry veneer.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

3.3 INSTALLATION OF MANUFACTURED ROOF FLASHINGS

A. General: Install manufactured roof flashings according to manufacturer's written instructions. Anchor to resist specified uplift and outward forces. Use fasteners, separators, sealants, and other miscellaneous items as required to complete manufactured roof specialty systems.
   1. Install manufactured roof flashings with provisions for thermal and structural movement.
   2. Torch cutting of manufactured roof specialties is not permitted.
   3. Do not use graphite pencils to mark metal surfaces.

B. Install manufactured roof flashings level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.

C. Install manufactured roof flashings to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.

D. Fasteners: Use fasteners of type and size recommended by manufacturer but of sizes that will penetrate substrate not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.

E. Seal joints with elastomeric sealant as required by manufacturer of roofing specialties.

F. Installation of Custom Roof-Edge Strip (Decks): Set cleat over membrane and into blocking with concealed fasteners 6 inches o.c. Install snap-on metal fascia cover and strip into single ply membrane. Install to resist wind blow-off and prevent flutter and vibration. Allow for expansion and contraction, making square, straight corners and tight overlaps, free of gaps and openings, properly sealed to be watertight

3.4 CUSTOM FABRICATED FLASHING AND TRIM INSTALLATION

A. General: Except as otherwise indicated, install sheet metal flashing and trim comply with fabricator’s installation instructions, performance requirements, and SMACNA "Architectural Sheet Metal Manual, Seventh Edition." Anchor units of work securely in place by methods indicated, providing for thermal expansion of metal units; conceal fasteners where possible; and set units true to line and level as indicated. All edge strips shall be neatly folded; external and internal corners shall be mitered and soldered for zinc-tin alloy-coated copper, and sealed in full bed of water cut off mastic for pre-finished metal. Install work with laps, joints, and seams that will be permanently watertight and weatherproof.
   1. Fabricate in minimum 96-inch-long sections, but not exceeding 12-foot-long sections.

B. Back-Up Plates: Where specified, set flashing ends in full bed of water cut-off mastic, allowing 1/4-inch between sections.

C. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing into receivers and fit tightly to base flashing. Extend counterflashing 4 inches over base flashing. Lap counterflashing joints a minimum of 4 inches and bed with elastomeric sealant.
   1. Verify correct installation of receiver flashing with back-up plates properly set and sealed at joints for two-piece counter flashing detail.

D. Install flashing and sheet metal with concealed fasteners, unless indicated otherwise. Metal edge flashing shall be installed to resist wind blow-off and prevent flutter and vibration. Allow

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

for expansion and contraction, making square, straight corners and tight overlaps, free of gaps and openings, properly sealed to be watertight.

E. Electrolytic Action: Where two dissimilar metals adjoin or lap each other (example: galvanized metal ducts and copper cap flashing), an approved separating strip or other insulating material shall be installed.

F. Bed flanges of work in water cut off mastic where required for waterproof performance.

3.5 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder and sealants.

C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.

D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

3.6 INSTALLER'S WARRANTY

A. WHEREAS <**Insert name**> of <**Insert address**>, herein called the "Installer," has performed siding, roofing, flashing and associated work ("work") on the following project:
1. Owner: <**Insert name of Owner.**>
2. Address: <**Insert address.**>
3. Building Name/Type: <**Insert information.**>
4. Address: <**Insert address.**>
5. Area of Work: <**Insert information.**>
6. Acceptance Date: <**Insert date.**>
7. Warranty Period: <**Insert time.**>
8. Expiration Date: <**Insert date.**>

B. AND WHEREAS Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,

C. NOW THEREFORE Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will, at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.

D. This Warranty is made subject to the following terms and conditions:
1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:
a. lightning;

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

b. peak gust wind speed exceeding 72 mph;
c. fire;
d. failure of siding and roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
e. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
f. vapor condensation on bottom of work; and
g. activity on work by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.

2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
3. Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.
4. During Warranty Period, if Owner allows alteration of work by anyone other than Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Installer to perform said alterations, Warranty shall not become null and void unless Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.
5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.
6. Owner shall promptly notify Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
7. This Warranty is recognized to be the only warranty of Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of siding, roofing, flashing, or trim failure. Specifically, this Warranty shall not operate to relieve Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this <Insert day> day of <Insert month>, <Insert year>.
1. Authorized Signature: <**Insert signature.>**
2. Name: <**Insert name.>**
3. Title: <**Insert title.>**

END OF SECTION 076200

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

SECTION 077200 - ROOF ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Roof hatches.

B. Related Sections:
   1. Division 05 Section "Metal Fabrications" for metal alternating tread stair for access to roof hatches.
   2. Division 08 Section "Unit Skylights" for double-glazed domed plastic skylights with curb frame.

1.3 PERFORMANCE REQUIREMENTS

A. General Performance: Roof accessories shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of roof accessory indicated. Include manufacturer's detailed technical product data; installation instructions and recommendations; and construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For roof accessories. Include plans, elevations, keyed details, rough-in requirements, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between plant- and field-assembled work.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For roof accessories to include in operation and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Sheet Metal Standard: Comply with the following:
   1. SMACNA's "Architectural Sheet Metal Manual" details for fabrication of units, including flanges and cap flashing to coordinate with type of roofing indicated.
   2. NRCA's "Roofing and Waterproofing Manual" details for installing units.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1.7 COORDINATION

A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.

B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

PART 2 - PRODUCTS

2.1 METAL MATERIALS

A. Aluminum Sheet: ASTM B 209, manufacturer's standard alloy for finish required, with temper to suit forming operations and performance required.
   1. Mill Finish: As manufactured.

B. Aluminum Extrusions and Tubes: ASTM B 221, manufacturer's standard alloy and temper for type of use, finished to match assembly where used, otherwise mill finished.

C. Steel Shapes: ASTM A 36/A 36M, hot-dip galvanized according to ASTM A 123/A 123M unless otherwise indicated.

D. Steel Tube: ASTM A 500, round tube.

E. Galvanized-Steel Tube: ASTM A 500, round tube, hot-dip galvanized according to ASTM A 123/A 123M.

F. Steel Pipe: ASTM A 53/A 53M, galvanized.

2.2 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.

B. Polyisocyanurate Board Insulation: ASTM C 1289, thickness as indicated.

C. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, acceptable to authorities having jurisdiction, containing no arsenic or chromium, and complying with AWPA C2; not less than 1-1/2 inches thick.

D. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

E. Fasteners: Roof accessory manufacturer's recommended fasteners suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:
   1. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
   2. Fasteners into Preservative-Treated Lumber: Series 300 stainless steel.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

F. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.

G. Elastomeric Sealant: ASTM C 920, elastomeric polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.

2.3 ROOF HATCH

A. Roof Hatches: Metal roof-hatch units with lids and insulated double-walled curbs, welded or mechanically fastened and sealed corner joints, continuous lid-to-curb counterflashing and weathertight perimeter gasketing, and integrally formed deck-mounting flange at perimeter bottom.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Model F-NB-50 manufactured by The Bilco Company or comparable product by one of the following:
      a. Milcor Inc.; Commercial Products Group of Hart & Cooley, Inc.
      b. Nystrom.

B. Type and Size: Single-leaf lid, 30 by 54 inches.

C. Loads: Minimum 40-lbf/sq. ft. external live load and 20-lbf/sq. ft. internal uplift load.

D. Hatch Material: Aluminum sheet, 0.090 inch thick; mill finish.

E. Construction:
   1. Insulation: Polyisocyanurate board, 2 inches thick, for both lid and curb. Insulation shall be fully covered and protected by an interior liner panel.
   2. Hatch Lid: Opaque, insulated, and double walled, with manufacturer's standard metal liner of same material and finish as outer metal lid.
   3. Curb Liner: Manufacturer's standard, of same material and finish as metal curb.
   4. Fabricate curbs to minimum height of 12 inches, unless otherwise indicated.

F. Hardware: Galvanized -steel spring latch with turn handles, both inside and exterior, stainless steel butt- or pintle-type hinge system, and padlock hasps inside and outside.

G. Safety Railing System: Roof-hatch manufacturer's standard system including rails, clamps, fasteners, safety barrier at railing opening, and accessories required for a complete installation; attached to roof hatch and complying with 29 CFR 1910.23 requirements, OSHA strength requirements with a safety factor of two, and authorities having jurisdiction.
   1. Height: 42 inches above finished roof deck.
   2. Posts and Rails: Galvanized-steel pipe, 1-1/4 inches in diameter or galvanized-steel tube, 1-5/8 inches in diameter.
   3. Maximum Opening Size: System constructed to prevent passage of a sphere 21 inches in diameter.
   4. Self-Latching Gate: Fabricated of same materials and rail spacing as safety railing system. Provide manufacturer's standard noncorrosive hinges and self-latching mechanism.
   5. Post and Rail Tops and Ends: Weather resistant, closed or plugged with prefabricated end fittings.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

6. Provide weep holes or another means to drain entrapped water in hollow sections of handrail and railing members.
7. Fabricate joints exposed to weather to be watertight.
8. Fasteners: Manufacturer's standard, finished to match railing system.
9. Finish: Manufacturer's standard.

2.4 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

C. Verify dimensions of roof openings for roof accessories.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install roof accessories according to manufacturer's written instructions and recommendations. Coordinate installation of roof accessories with installation of roof deck, roof insulation, flashing, roofing membranes, penetrations, equipment, and other construction involving roof accessories to ensure that each element of the Work performs properly.
1. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.
2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.
5. Install roof accessories to fit substrates and to result in watertight performance.
6. Install roof accessory items according to construction details of NRCA's "Roofing and Waterproofing Manual," unless otherwise indicated.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

C. Roof-Hatch Installation:
   1. Install roof hatch so top surface of hatch curb is level.
   2. Verify that roof hatch operates properly. Clean, lubricate, and adjust operating mechanism and hardware.
   3. Attach safety railing system to roof-hatch curb.

3.3 REPAIR AND CLEANING

A. Clean exposed surfaces according to manufacturer's written instructions.

B. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 077200

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

SECTION 078110 - SPRAYED FIRE-RESISTIVE MATERIALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
1. Concealed cementitious fireproofing (SFRM) for beams and columns.
2. Patching of in-place SFRM damaged or disturbed by installation of attachments and other construction during remainder of construction.

B. Related Sections include the following:
1. Division 05 Section "Structural Steel Framing" for surface conditions required for structural steel receiving SFRM.
2. Division 07 Section "Penetration Firestopping" for fire-resistance-rated firestopping systems.
3. Division 07 Section "Fire-Resistive Joint Systems" for fire-resistance-rated joint systems.
4. Division 09 Section "Gypsum Board Assemblies" for gypsum-board-based fire protection.

1.3 DEFINITIONS

A. SFRM: Sprayed fire-resistive material.

B. Concealed: Fire-resistive materials applied to surfaces that are concealed from view behind other construction when the Work is completed.

C. Cementitious Mixture: As identified by Underwriters Laboratories Inc. in the latest edition of the UL Fire Resistance Directory under category CHPX, Spray-Applied Fire Resistive Material.

1.4 SUBMITTALS

A. General: Submit in accordance with Division 01 Section "Submittal Procedures."

B. Product Data: For each type of product indicated. Include manufacturer's instructions for proper application of and repairs to spray-applied fireproofing.

C. Shop Drawings: Structural framing plans indicating the following:
1. Locations and types of surface preparations required before applying SFRM.
2. Extent of SFRM for each construction and fire-resistance rating, including the following:
a. Applicable fire-resistance design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.
b. Minimum thicknesses needed to achieve required fire-resistance ratings of structural components and assemblies.
3. Treatment of SFRM after application.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

D. Thickness Schedule: Indicating material to be used, building elements to be protected with SFRM, indication of restrained and unrestrained conditions, hourly rating and material thickness provided and appropriate references.

E. Product Certificates: For each type of SFRM, signed by product manufacturer indicating products comply with requirements.

F. Qualification Data: For Installer.

G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for proposed SFRM.

1.5 QUALITY ASSURANCE

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

B. Source Limitations: Obtain SFRM through one source from a single manufacturer.

C. SFRM Testing: Owner will engage a qualified testing and inspecting agency to test for compliance with specified requirements for performance and test methods.
1. SFRMs shall be randomly selected for testing from bags bearing the applicable classification marking of UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
2. Testing shall be performed on specimens of SFRMs that comply with laboratory testing requirements specified in Part 2 and are otherwise identical to installed fire-resistive materials, including application of accelerant, sealers, topcoats, tamping, troweling, rolling, and water overspray, if any of these are used in final application.
3. Testing shall be performed on specimens whose application the independent testing and inspecting agency witnessed during preparation and conditioning. Test reports shall include a full description of preparation and conditioning of laboratory test specimens.

D. Compatibility and Adhesion Testing: Owner will engage a qualified testing and inspecting agency to test for compliance with requirements for specified performance and test methods.
1. Bond Strength: Test for cohesive and adhesive strength according to ASTM E 736. Provide bond strength indicated in referenced fire-resistance design, but not less than minimum specified in Part 2.
2. Density: Test for density according to ASTM E 605. Provide density indicated in referenced fire-resistance design, but not less than minimum specified in Part 2.
3. Verify that manufacturer, through its own laboratory testing or field experience, has not found primers or coatings to be incompatible with SFRM.
4. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
5. For materials failing tests, obtain applied-fireproofing manufacturer's written instructions for corrective measures including the use of specially formulated bonding agents or primers.

E. Fire-Test-Response Characteristics: Provide SFRM with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

another testing and inspecting agency acceptable to authorities having jurisdiction. Identify bags containing SFRM with appropriate markings of applicable testing and inspecting agency.

1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency acceptable to authorities having jurisdiction, for SFRM serving as direct-applied protection tested per ASTM E 119.
2. Surface-Burning Characteristics: ASTM E 84.

F. Provide products containing no detectable asbestos as determined according to the method specified in 40 CFR 763, Subpart E, Appendix E, Section 1, "Polarized Light Microscopy."

G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to SFRM including, but not limited to, the following:

1. Meet with Architect, Owner, Installer, independent testing laboratory, representative of SFRM manufacturer, and installers whose work interfaces with or affects SFRM.
2. Review products, exposure conditions, design ratings, restrained and unrestrained conditions, calculations, densities, thicknesses, bond strengths, and other performance requirements.
3. Review and finalize construction schedule and verify sequencing and coordination requirements.
4. Review weather predictions, ambient conditions, and proposed temporary protections for SFRM during and after installation.
5. Review surface conditions and preparations.
6. Verify sequencing and coordination requirements, method of application, and applied thicknesses.
7. Review field quality-control testing procedures.
8. Record discussions and agreements and furnish copy to each participant.
9. Provide not less than 7 business days advance notification to participants prior to convening preinstallation conference.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to Project site in original, unopened packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, shelf life if applicable, and fire-resistance ratings applicable to Project.

B. Use materials with limited shelf life within period indicated. Remove from Project site and discard materials whose shelf life has expired.

C. Store materials inside, under cover, and aboveground; keep dry until ready for use. Remove from Project site and discard wet or deteriorated materials or materials previously exposed to water.

1. Replace discarded materials at no additional expense to Owner.

1.7 PROJECT CONDITIONS

A. Environmental Limitations:

1. Concealed Cementitious SFRM: Do not apply SFRM when ambient or substrate temperature is 40 deg F or lower unless temporary protection and heat are provided to

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

maintain temperature at or above this level for 24 hours before, during, and for 24 hours after product application.

B. Ventilation: Ventilate building spaces during and after application of SFRM to achieve not less than 4 total air exchanges per hour until material is substantially dry. Use natural means or, if they are inadequate, forced-air circulation until fire-resistive material dries thoroughly.

1.8 COORDINATION

A. Sequence and coordinate application of SFRM with other related work specified in other Sections to comply with the following requirements:
   1. Provide temporary enclosure as required to confine spraying operations and protect the environment.
   2. Provide temporary enclosures for applications to prevent deterioration of fire-resistive material due to exposure to weather and to unfavorable ambient conditions for humidity, temperature, and ventilation.
   3. Avoid unnecessary exposure of fire-resistive material to abrasion and other damage likely to occur during construction operations subsequent to its application.
   4. Do not begin applying fire-resistive material until clips, hangers, supports, sleeves, and other items penetrating fire protection are in place.
   5. Defer installing ducts, piping, and other items that would interfere with applying fire-resistive material until application of fire protection is completed.
   6. Do not install enclosing or concealing construction until after fire-resistive material has been applied, inspected, and tested and corrections have been made to defective applications.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Assemblies: Provide fireproofing, including auxiliary materials, according to requirements of each fire-resistance design and manufacturer's written instructions.

B. Fire-Resistance Design: Indicated in Fire Rating Schedule in Part 3, tested according to ASTM E 119 or UL 263 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Steel members are to be considered unrestrained unless specifically noted otherwise.

C. Asbestos: Provide products containing no detectable asbestos.

2.2 CONCEALED CEMENTITIOUS FIREPROOFING

A. Products: Subject to compliance with requirements, provide one of the following:
   1. Concealed Cementitious SFRM:
      a. Grace, W. R. & Co. - Conn., Construction Products Div.; Monokote Type MK-6 MK-6/HY.
      b. Isolatek International Corp.; Cafco 300.
         1) Blaze Shield II is not an acceptable substitution.
   2. Concealed Cementitious SFRM for Beams and Columns within and directly above the Covered Parking Area.

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

a. Grace, W. R. & Co. - Conn., Construction Products Div.; Monokote Type Z-106 or Z-106/HY.
b. Isolatek International Corp.; Cafco 400.

B. Material Composition: Manufacturer's standard product, as follows:
1. Concealed Cementitious SFRM: Factory-mixed, dry formulation of gypsum or portland cement binders, mold inhibitor, additives, and lightweight mineral or synthetic aggregates mixed with water at Project site to form a slurry or mortar for conveyance and application.
2. Aggregate Slurry Fireproofing SFRM (Unconditioned Areas - Covered Parking): Factory-blended cement based aggregate slurry fireproofing with mold inhibitor to be mixed with water at Project site to form a slurry or mortar for conveyance and application.

C. Physical Properties: Minimum values, unless otherwise indicated, or higher values required to attain designated fire-resistance ratings, measured per standard test methods referenced with each property as follows:
1. Concealed Cementitious SFRM Dry Density: 15 lb/cu. ft. for average and individual densities, or greater to attain fire-resistance ratings indicated, per ASTM E 605.
2. Aggregate Slurry Fireproofing SFRM (Covered Parking) Dry Density: Not less than 22 lb/cu. ft. for average and individual densities, or greater to attain fire-resistance ratings indicated, per ASTM E 605.
3. Thickness: Minimum average thickness required for fire-resistance design indicated according to the following criteria, but not less than 0.375 inch, per ASTM E 605:
   a. Where the referenced fire-resistance design lists a thickness of 1 inch or more, the minimum allowable individual thickness of SFRM is the design thickness minus 0.25 inch.
   b. Where the referenced fire-resistance design lists a thickness of less than 1 inch but more than 0.375 inch, the minimum allowable individual thickness of SFRM is the greater of 0.375 inch or 75 percent of the design thickness.
   c. No reduction in average thickness is permitted for those fire-resistance designs whose fire-resistance ratings were established at densities of less than 15 lb/cu. ft..
4. Bond Strength: Minimum average bond strength of 200 lbf/sq. ft. and minimum individual bond strength of 150 lbf/sq. ft. per ASTM E 736 based on laboratory testing of 0.75-inch minimum thickness of SFRM.
5. Compressive Strength: 5.21 lbf/sq. in. minimum per ASTM E 761. Minimum thickness of SFRM tested shall be 0.75 inch and minimum dry density shall be as specified but not less than 15 lb/cu. ft. Fireproofing shall not deform more than 10 percent when subjected to compressive forces of 1200 psf when tested in accordance with ASTM E 761.
6. Corrosion Resistance: No evidence of corrosion per ASTM E 937.
7. Deflection: No cracking, spalling, or delamination per ASTM E 759.
8. Effect of Impact on Bonding: No cracking, spalling, or delamination per ASTM E 760.
9. Impact Penetration: Fireproofing material shall not show a loss of more than 6 cm^3 when subjected to impact penetration tests in accordance with test methods developed by City of San Francisco, Bureau of Building Inspection.
10. Abrasion Resistance: No more than 15 cm^3 shall be abraded or removed from fireproofing substrate when tested in accordance with test methods developed by City of San Francisco, Bureau of Building Inspection.
11. Air Erosion: Maximum weight loss of 0.005 g/sq. ft. in 24 hours per ASTM E 859. For laboratory tests, minimum thickness of SFRM is 0.75 inch, maximum dry density is 15

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

lb/cu. ft., test specimens are not prepurged by mechanically induced air velocities, and tests are terminated after 24 hours.

a. High Speed Air Erosion: Materials to be used in plenums or ducts shall exhibit no continued erosion after 4 hours at an air speed of 2500 ft/min per ASTM E 859 and UMC Standard 6-1.

12. Fire-Test-Response Characteristics: Provide SFRM with the following surface-burning characteristics as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
    a. Flame-Spread Index: 10 or less.
    b. Smoke-Developed Index: 0.
13. Combustibility: Maximum total heat release of 20 MJ/m² and a maximum 125 kW/m2 peak rate of heat release 600 seconds after insertion per ASTM E 1354 at a radiant heat flux of 75 kW/m2 with use of electric spark ignition. Sample shall be tested in the horizontal orientation.
14. Fungal Resistance: No observed growth on specimens per ASTM G 21 for not less than 28 days for general use and not less than 60 days for use in plenums.

D. Fire-Resistance Classification: Material shall have been tested and reported by UL in accordance with ASTM E 119 and shall be listed in the Underwriters Laboratories Fire Resistance Directory.

E. Mixing water shall be clean, fresh, and potable and free from such amounts of mineral or organic substances as would affect the set of fireproofing material. Provide water with sufficient pressure and volume to meet fireproofing application schedule.

2.3 AUXILIARY FIRE-RESISTIVE MATERIALS

A. General: Provide auxiliary fire-resistive materials that are compatible with SFRM and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated. Such accessories include, but are not limited to, any required or optional items such as bonding agents; mechanical attachments; application aids such metal lath, scrim, or netting; and accelerator.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrates and other conditions affecting performance of work. A substrate is in satisfactory condition if it complies with the following:
1. Substrates comply with requirements in the Section where the substrate and related materials and construction are specified.
2. Substrates are free of dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, incompatible primers, incompatible paints, incompatible encapsulants, or other foreign substances capable of impairing bond of fire-resistive materials with substrates under conditions of normal use or fire exposure.
3. Objects penetrating fire-resistive material, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.
4. Substrates are not obstructed by ducts, piping, equipment, and other suspended construction that will interfere with applying fire-resistive material.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

B. Verify that concrete work on steel deck has been completed.

C. Conduct tests according to fire-resistive material manufacturer's written recommendations to verify that substrates are free of substances capable of interfering with bond.

D. If unacceptable conditions are encountered, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Cover other work subject to damage from fallout or overspray of fire-resistive materials during application. Provide temporary enclosure as required to confine spraying operations, protect the environment, and ensure maintenance of adequate ambient conditions for temperature and ventilation.

B. Clean substrates of substances that could impair bond of fire-resistive material, including dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, rust and incompatible primers, paints, and encapsulants.

3.3 APPLICATION, GENERAL

A. Comply with fire-resistive material manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and spray on fire-resistive material, as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.

B. Apply SFRM that is identical to products tested as specified in Part 1 "Quality Assurance" Article and substantiated by test reports, with respect to rate of application, accelerator use, sealers, topcoats, tamping, troweling, water overspray, or other materials and procedures affecting test results.

C. Extend fire-resistive material in full thickness over entire area of each substrate to be protected. Unless otherwise recommended in writing by SFRM manufacturer, install body of fire-resistive covering in a single course.

D. Spray apply fire-resistive materials to maximum extent possible. Following the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by SFRM manufacturer.

E. Extend fireproofing in full thickness over entire area of each substrate to be protected.

F. Install body of fireproofing in a single course unless otherwise recommended in writing by fireproofing manufacturer.

G. Cure fireproofing according to fireproofing manufacturer's written recommendations.

H. Post appropriate cautionary "Slippery When Wet" signs in all areas in contact with wet fireproofing material. Erect appropriate barriers to prevent entry by non-fireproofing workers into fireproofing spray and mixing areas and other areas exposed to wet fireproofing material.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

3.4 APPLICATION, CONCEALED SFRM

A. Apply concealed SFRM in thicknesses and densities not less than those required to achieve fire-resistance ratings designated for each condition, but apply in greater thicknesses and densities if specified.

B. Cure SFRM according to product manufacturer's written recommendations to prevent premature drying.

3.5 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspection and prepare reports:
   1. Test and inspect as required by the IBC, 1704.11.
   2. Testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.

B. Perform the tests and inspections of completed Work in successive stages. Do not proceed with application of fireproofing for the next area until test results for previously completed applications of fireproofing show compliance with requirements. Tested values must equal or exceed values as specified and as indicated and required for approved fire-resistance design.

C. Fireproofing will be considered defective if it does not pass tests and inspections.
   1. Remove and replace fireproofing that does not pass tests and inspections, and retest.
   2. Apply additional fireproofing, per manufacturer's written instructions, where test results indicate insufficient thickness, and retest.

D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

E. Prepare test and inspection reports.

3.6 CLEANING, PROTECTING, AND REPAIR

A. Cleaning: Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.

B. Protect fireproofing, according to advice of product manufacturer and Installer, from damage resulting from construction operations or other causes so fireproofing will be without damage or deterioration at time of Substantial Completion.

C. Coordinate application of fireproofing with other construction to minimize need to cut or remove fire protection. As installation of other construction proceeds, inspect fireproofing and patch any damaged or removed areas.

D. Repair or replace work that has not successfully protected steel.

E. Repair fireproofing damaged by other work before concealing it with other construction.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

F. Repair fireproofing by reapplying it using same method as original installation or using manufacturer's recommended trowel-applied product.

3.7 FIRE RATING SCHEDULE

A. Locations: Protect indicated metal deck in accordance with the following schedule:

Cementitious Fireproofing: Unrestrained assembly rating for all elements.

	Element	Hour	Reference
1.	Tube Columns:	1	Y710
2.	Floor Beams	1	Thickness similar to X772/X790

END OF SECTION 078110

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

SECTION 078413 - THROUGH-PENETRATION FIRESTOP SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Penetrations in fire-resistance-rated walls.
2. Penetrations in horizontal assemblies.
3. Penetrations in smoke barriers.
4. Compliance with requirements of UL assemblies indicated for fire-rated construction.

B. Related Sections:
1. Division 07 Section "Fire-Resistive Joint Systems" for joints in or between fire-resistance-rated construction.
2. Division 07 Section "Joint Sealants" for non-fire-resistive joint sealants.
3. Division 09 Section "Gypsum Board Assemblies" for firestopping where fire rated gypsum board assemblies butt adjacent construction including joists, beams, floors, roofs and structural members.
4. Division 21, 22 and 23 Sections specifying duct and piping penetrations, including fire-suppression piping.
5. Division 26 and 27 Sections specifying cable and conduit penetrations.

1.3 SUBMITTALS

A. General: Submit in accordance with Division 01 Section "Submittal Procedures."

B. Product Data: For each type of product proposed for use. Include product characteristics, typical uses, performance and limitation criteria, test data, and installation instructions.

C. Shop Drawings: For each through-penetration firestop system, show each kind of construction condition penetrated, relationships to adjoining construction, and kind of penetrating item. Include firestop design designation of testing and inspecting agency acceptable to authorities having jurisdiction that evidences compliance with requirements for each condition required.
1. Submit documentation, including illustrations applicable to each through-penetration firestop system configuration for construction and penetrating items.
2. Where Project conditions require modification of qualified testing and inspecting agency's illustration to suit a particular through-penetration firestop condition, submit illustration, with modifications marked, approved by through-penetration firestop system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.
3. For those firestopping applications that exist for which no UL tested system is available through a manufacturer, a manufacturer's engineering judgement derived from a similar UL system design or other tests shall be submitted to local authorities having jurisdiction

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

for their review and approval prior to installation. Manufacturer's engineering judgement shall follow requirements set forth by the International Firestop Council.

D. Product Schedule: For each penetration firestopping system. Include location and design designation of qualified testing and inspecting agency.

E. Qualification Data: For qualified Installer.

F. Installer Certificates: From Installer indicating penetration firestopping has been installed in compliance with requirements and manufacturer's written recommendations.

G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified, independent testing agency, for penetration firestopping.

H. Sample: Sample of identification tags.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A firm experienced in installing penetration firestopping similar in material, design, and extent to that required for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its penetration firestopping products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.

B. Installation Responsibility: Assign installation of through-penetration firestop systems and fire-resistive joint systems in Project to a single qualified installer.

C. Fire-Test-Response Characteristics: Penetration firestopping shall comply with the following requirements:
   1. Penetration firestopping tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.
   2. Penetration firestopping is identical to those tested per testing standard referenced in "Penetration Firestopping" Article. Provide rated systems complying with the following requirements:
      a. Penetration firestopping products bear classification marking of qualified testing and inspecting agency.
      b. Classification markings on penetration firestopping correspond to designations listed by the following:
         1) UL in its "Fire Resistance Directory."
         2) Intertek ETL SEMKO in its "Directory of Listed Building Products."
         3) FM Global in its "Building Materials Approval Guide."

D. Provide through-penetration firestop system products containing no detectable asbestos as determined by the method specified in 40 CFR Part 763, subpart F, Appendix A, Section 1, "Polarized Light Microscopy."

E. Preinstallation Conference: Conduct conference at Project site.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver through-penetration firestop system products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer; date of manufacture; lot number; shelf life, if applicable; qualified testing and inspecting agency's classification marking applicable to Project; curing time; and mixing instructions for multicomponent materials.

B. Store and handle materials for through-penetration firestop systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not install penetration firestopping when ambient or substrate temperatures are outside limits permitted by penetration firestopping manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.

B. Install and cure penetration firestopping per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.7 COORDINATION

A. Coordinate Work of this Section with the work of other trades to assure the proper sequencing of each installation and to provide a fire- and smoke-resistant installation.

B. Coordinate construction of openings and penetrating items to ensure that penetration firestopping is installed according to specified requirements.

C. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping.

D. Notify Owner's testing agency at least seven days in advance of penetration firestopping installations; confirm dates and times on day preceding each series of installations.

E. Do not cover up through-penetration firestop system installations that will become concealed behind other construction until each installation has been examined by Owner's inspecting agency and building inspector, if required by authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Bio Fireshield, Carlisle, MA.
2. Grace Construction Products.
3. Hilti, Inc.
4. Nelson Firestop Products.
5. RectorSeal Corporation.
6. Specified Technologies Inc.

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

7. 3M Fire Protection Products.
8. Tremco, Inc.; Tremco Fire Protection Systems Group.

2.2 PENETRATION FIRESTOPPING

A. Provide penetration firestopping that is produced and installed to resist spread of fire according to requirements required, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.
   1. Provide paintable penetration firestopping products at locations exposed to view in public and tennant spaces. Mechanical, electrical and elevator machine rooms are not considered public spaces.

B. Penetrations in Fire-Resistance-Rated Walls: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
   1. Fire-resistance-rated walls include fire walls and fire partitions.
   2. F-Rating: Not less than the fire-resistance rating of constructions penetrated.

C. Penetrations in Horizontal Assemblies: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
   1. Horizontal assemblies include floors, floor/ceiling assemblies, and ceiling membranes of roof/ceiling assemblies.
   2. F-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated.
   3. T-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.

D. Penetrations in Smoke Barriers: Provide penetration firestopping with ratings determined per UL 1479.
   1. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at 0.30-inch wg at both ambient and elevated temperatures.

E. Exposed Penetration Firestopping: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

F. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping manufacturer and approved by qualified testing and inspecting agency for firestopping indicated.
   1. Permanent forming/damming/backing materials, including the following:
      a. Slag-wool-fiber or rock-wool-fiber insulation.
      b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
      c. Fire-rated form board.
      d. Fillers for sealants.
   2. Temporary forming materials.
   3. Substrate primers.
   4. Collars.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

5. Steel sleeves.

2.3 FILL MATERIALS

A. General: Provide penetration firestopping systems containing the types of fill materials indicated in the Through-Penetration Firestop System Schedule submitted. Fill materials are those referred to in directories of referenced testing and inspecting agencies as "fill," "void," or "cavity" materials.

B. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.

C. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.
1. Products:

D. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

E. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized-steel sheet.

F. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.

G. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.

H. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.

I. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.

J. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

K. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:
1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces.

L. Accessories: Forming/damming materials composed of mineral fiberboard or other type as recommended by through-penetration firestop systems manufacturer.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

2.4 MIXING

A. For those products requiring mixing before application, comply with penetration firestopping manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application required.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Clean out openings immediately before installing penetration firestopping to comply with manufacturer's written instructions and with the following requirements:
   1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping.
   2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping. Remove loose particles remaining from cleaning operation.
   3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent penetration firestopping from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing firestopping's seal with substrates.

3.3 INSTALLATION

A. General: Install penetration firestopping to comply with manufacturer's written installation instructions and published drawings for products and applications required.

B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
   1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestopping.

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

C. Install fill materials for firestopping by proven techniques to produce the following results:
   1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
   2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
   3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

A. Identify penetration firestopping with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of firestopping edge so labels will be visible to anyone seeking to remove penetrating items or firestopping. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
   1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
   2. Contractor's name, address, and phone number.
   3. Designation of applicable testing and inspecting agency, system number and date.
   4. Date of installation.
   5. Manufacturer's name.
   6. Installer's name.

3.5 FIELD QUALITY CONTROL

A. Owner may engage a qualified testing agency to perform tests and inspections.

B. Allow for 3 random samples of each type of firestopping system to be inspected. Reinstall disturbed samples to comply with requirements.

C. Where deficiencies are found or penetration firestopping is damaged or removed because of testing, repair or replace penetration firestopping to comply with requirements.

D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

E. Proceed with enclosing penetration firestopping with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping is without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping and install new materials to produce systems complying with specified requirements.

END OF SECTION 078413

62 India Str
Portland, M
DD

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

SECTION 078446 - FIRE-RESISTIVE JOINT SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes fire-resistive joint systems for the following:
   1. Floor-to-floor joints.
   2. Floor-to-wall joints.
   3. Head-of-wall joints.
   4. Wall-to-wall joints.
   5. Wall-to-adjacent structure and supports.
   6. Compliance with requirements of UL assemblies indicated for fire-rated construction.

B. Related Sections include the following:
   1. Division 07 Section "Through-Penetration Firestop Systems" for systems installed in openings in walls and floors with and without penetrating items.
   2. Division 07 Section "Joint Sealants" for non-fire-resistive joint sealants.
   3. Division 09 Section "Gypsum Board Assemblies" for firestopping where fire rated gypsum board assemblies butting adjacent construction including masonry, steel deck, joists, beams, floors, roofs and structural members.

1.3 PERFORMANCE REQUIREMENTS

A. General: Provide fire-resistive joint systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assembly in which fire-resistive joint systems are installed. Fire-resistive joint systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases.

B. Joint Systems in and between Fire-Resistance-Rated Constructions: Provide systems with assembly ratings equaling or exceeding the fire-resistance ratings of construction that they join, and with movement capabilities and L-ratings indicated as determined by UL 2079.
   1. Load-bearing capabilities as determined by evaluation during the time of test.
   2. For fire-resistance systems with movement capabilities, allow for the following movement.
      a. Floors: 3/4-inch deflection.
      b. Roofs: 1 -inch deflection.
   3. Provide systems with L-rating where walls and partitions also are smoke barriers. Where a fire-resistive joint system is not available with the ability to resist smoke, provide smoke sealant material to one side of wall to stop the passage of smoke.

C. For fire-resistive systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1. For fire-resistive joint systems exposed to view in public spaces upon completion of Work, provide products that are paintable.
   a. Mechanical, electrical and elevator machine rooms are not considered public spaces.

1.4 SUBMITTALS

A. General: Submit in accordance with Division 01 Section "Submittal Procedures."

B. Product Data: For each type of product proposed for use. List product characteristics, typical uses, performance and limitation criteria, test data, and installation instructions.

C. Shop Drawings: For each fire-resistive joint system, show each kind of construction condition in which joints are installed; also show relationships to adjoining construction. Include fire-resistive joint system design designation of testing and inspecting agency acceptable to authorities having jurisdiction that demonstrates compliance with requirements for each condition indicated.
   1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each fire-resistive joint system configuration for construction and penetrating items.
   2. For those fire-resistive joint system applications that exist for which no UL tested system is available through a manufacturer, a manufacturer's engineering judgment derived from a similar UL system design or other tests shall be submitted to local authorities having jurisdiction for their review and approval prior to installation. Manufacturer's engineering judgment shall follow requirements set forth by the International Firestop Council.

D. Product Certificates: For each type of fire-resistive joint system, signed by product manufacturer.

E. Qualification Data: For Installer.

F. Field quality-control test reports.

G. Evaluation Reports: Evidence of fire-resistive joint systems' compliance with ICBO ES AC30, from the ICBO Evaluation Service.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A firm experienced in installing fire-resistive joint systems similar in material, design, and extent to that required for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its fire-resistive joint system products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.

B. Installation Responsibility: Assign installation of through-penetration firestop systems and fire-resistive joint systems in Project to a single qualified installer.

C. Source Limitations: Obtain fire-resistive joint systems, for each kind of joint and construction condition indicated, through one source from a single manufacturer.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

D. Fire-Test-Response Characteristics: Provide fire-resistive joint systems that comply with the following requirements and those specified in Part 1 "Performance Requirements" Article:
   1. Fire-resistance tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL, OPL or another agency performing testing and follow-up inspection services for fire-resistive joint systems acceptable to authorities having jurisdiction.
   2. Fire-resistive joint systems are identical to those tested per methods indicated in Part 1 "Performance Requirements" Article and comply with the following:
      a. Fire-resistive joint system products bear classification marking of qualified testing and inspecting agency.
      b. Fire-resistive joint systems correspond to those indicated by referencing system designations of the qualified testing and inspecting agency.

E. Preinstallation Conference: Conduct conference at Project site.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver fire-resistive joint system products to Project site in original, unopened containers or packages with qualified testing and inspecting agency's classification marking applicable to Project and with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, lot number, shelf life, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials for fire-resistive joint systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

C. Remove and replace materials, at no cost to Owner, that cannot be applied within their stated shelf life.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not install fire-resistive joint systems when ambient or substrate temperatures are outside limits permitted by fire-resistive joint system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Ventilate fire-resistive joint systems per manufacturer's written instructions by natural means or, if this is inadequate, forced-air circulation.

1.8 COORDINATION

A. Coordinate construction of joints to ensure that fire-resistive joint systems are installed according to specified requirements.

B. Coordinate sizing of joints to accommodate fire-resistive joint systems.

C. Do not cover up fire-resistive joint system installations that will become concealed behind other construction until Owner's inspecting agency and building inspector or authorities having jurisdiction have examined each installation.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide products by one of the following:
1. A/D Fire Protection Systems Inc.
2. W.R. Grace & Co., Construction Products Division.
3. Hilti Construction Chemicals, Inc.
4. Johns Manville International, Inc.
5. Nelson Firestop Products
6. NUCO Inc.
7. RectorSeal Corporation (The)
8. Specified Technologies Inc.
9. 3M Fire Protection Products
10. Tremco Sealant/Weatherproofing Division
11. United States Gypsum Company.

2.2 FIRE-RESISTIVE JOINT SYSTEMS

A. Compatibility: Provide fire-resistive joint systems that are compatible with joint substrates, under conditions of service and application, as demonstrated by fire-resistive joint system manufacturer based on testing and field experience.

B. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials, that are needed to install fill materials and to comply with Part 1 "Performance Requirements" Article. Use only components specified by fire-resistive joint system manufacturer and approved by the qualified testing and inspecting agency for systems submitted.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Clean joints immediately before installing fire-resistive joint systems to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:
1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of fill materials.
2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with fill materials. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

B. Priming: Prime substrates where recommended in writing by fire-resistive joint system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent fill materials of fire-resistive joint system from contacting adjoining surfaces that will remain exposed on completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears of fire-resistive joint system materials from adjoining surfaces. Remove tape as soon as possible without disturbing fire-resistive joint system's seal with substrates or damaging adjoining surfaces.

3.3 INSTALLATION

A. General: Install fire-resistive joint systems to comply with Part 1 "Performance Requirements" Article and fire-resistive joint system manufacturer's written installation instructions for products and applications used.

B. Install forming/packing/backing materials and other accessories of types required to support fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistive joint system.

C. Install fill materials for fire-resistive joint systems by proven techniques to produce the following results:
1. Fill voids and cavities formed by openings and forming/packing/backing materials as required to achieve fire-resistance ratings indicated.
2. Apply fill materials so they contact and adhere to substrates formed by joints.
3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

A. Identify fire-resistive joint systems with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of joint edge so labels will be visible to anyone seeking to remove or penetrate joint system. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
1. The words "Warning - Fire-Resistive Joint System - Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's name, address, and phone number.
3. Designation of applicable testing agency.
4. Date of installation.
5. Manufacturer's name.
6. Installer's name.

3.5 FIELD QUALITY CONTROL

A. Inspecting Agency: Owner may engage a qualified independent inspecting agency to inspect fire-resistive joint systems and prepare inspection reports.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

B. Before installation of ceilings, walls, and adjacent construction that would conceal fire-resistive joint systems, inspect joints to verify complete installation of fire-resistive joint systems materials.

C. Remove and replace fire-resistive joint systems where inspections indicate that they do not comply with specified requirements.

D. Additional inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

E. Proceed with enclosing fire-resistive joint systems with other construction only after inspection reports are issued and fire-resistive joint systems comply with requirements.

3.6 CLEANING AND PROTECTING

A. Clean off excess fill materials adjacent to joints as Work progresses by methods and with cleaning materials that are approved in writing by fire-resistive joint system manufacturers and substrate manufacturers that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure fire-resistive joint systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated fire-resistive joint systems immediately and install new materials to produce fire-resistive joint systems complying with specified requirements.

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Inspections Division
Approved with Conditions
Date: 04/11/17

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes joint sealants for the following applications, including those specified by reference to this Section:
   1. Exterior joints in the following vertical surfaces and horizontal nontraffic surfaces:
      a. Construction and control joints in cast-in-place concrete.
      b. Control and expansion joints in unit masonry.
      c. Joints between different materials listed above.
      d. Perimeter joints between materials listed above and frames of doors, windows, and louvers and masonry veneer.
      e. Other joints as indicated.
   2. Exterior joints in the following horizontal traffic surfaces:
      a. Isolation and contraction joints in cast-in-place concrete slabs.
      b. Other joints as indicated.
   3. Interior joints in the following vertical surfaces and horizontal nontraffic surfaces:
      a. Control and expansion joints on exposed interior surfaces of exterior walls.
      b. Perimeter joints of exterior openings where indicated.
      c. Perimeter joints between interior wall surfaces and frames of interior doors, and elevator entrances.
      d. Joints between plumbing fixtures and adjoining walls, floors, and counters.
      e. Other joints as indicated.
   4. Interior joints in the following horizontal traffic surfaces:
      a. Isolation and control joints in exposed cast-in-place concrete slabs.
      b. Other joints as indicated.

B. Related Sections include the following:
   1. Division 04 Section "Unit Masonry Assemblies" for masonry joints to receive sealant.
   2. Division 07 Section "Weather Barriers" for sealants used in conjunction with air and weather barrier system applied to gypsum sheathing and for window and door nail fin tie-in.
   3. Division 07 Section "Fiber Cement Siding" for sealant in conjunction with siding and trim.
   4. Division 07 Section "Sheet Metal Flashing and Trim" for sealing joints related to flashing and sheet metal for roofing.
   5. Division 07 Section "Penetration Firestopping" for sealing penetrations in fire-resistance-rated construction.
   6. Division 07 Section "Fire-Resistive Joint Systems" for sealing joints in fire-resistance-rated construction.
   7. Division 08 Section "Clad Wood Windows" for sealing interior perimeter of window openings between frames and weather barrier.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

8. Division 09 Section "Gypsum Board Assemblies" for sealing perimeter joints of gypsum board partitions to reduce sound transmission.
9. Division 09 Section "Ceramic Tile" for sealing tile joints.
10. Divisions 21, 22, 23, and 26 for sealing of perimeter joints of plumbing, HVAC systems, automatic fire protection systems, telecommunication systems, and electrical systems.
11. Division 32 Sections for sealing joints in pavements, walkways, and curbing.

1.3 PERFORMANCE REQUIREMENTS

A. Provide joint sealants that have been produced and installed to establish and to maintain watertight and airtight continuous seals without causing staining or deterioration of joint substrates.

B. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

1.4 SUBMITTALS

A. General: Submit in accordance with Division 01 Section "Submittal Procedures."

B. Product Data: For each joint-sealant product indicated.

C. Joint-Sealant Schedule: Include the following information:
1. Joint-sealant application, joint location, and designation.
2. Joint design, including width and depth of joint sealant, and backer rod or bond-breaker size and location.
3. Joint-sealant manufacturer and product name.
4. Joint-sealant formulation.
5. Joint-sealant color.
6. Primer for each substrate type.
7. Solvent wipe cleaner for each substrate type.

D. Samples for Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has completed joint sealant applications similar in materials, design, and extent to that indicated for Project that have resulted in construction with a record of successful in-service performance.

B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use, shelf/pot life, curing time, and mixing instructions for multi-component materials.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

B. Store and handle materials in compliance with manufacturer's recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

C. Remove and replace materials, at no cost to Owner, that cannot be applied within their stated shelf life.

1.7 PROJECT CONDITIONS

A. Environmental Conditions: Do not proceed with installation of joint sealants under the following conditions:
   1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
   2. When joint substrates are wet.
   3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
   4. Contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

B. Joint Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than allowed by joint sealant manufacturer for application indicated.

C. Joint Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with their adhesion are removed from joint substrates.

1.8 SEQUENCING AND SCHEDULING

A. Coordinate Work of this Section with interfacing and adjoining Work for proper sequencing of each installation to ensure a weathertight installation.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.

B. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

C. Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

D. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range and custom colors. Allow for 3 custom colors to be used on the project.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

2.2 JOINT SEALANTS

A. Type 1 - General Purpose Exterior Sealant: Polyurethane; ASTM C920, Type S, Grade NS, Class 25; single component.
1. Sonolastic NP-1; Sonneborn, Division of ChemRex Inc.
2. Dymonic; Tremco.
3. Sikaflex-1a; Sika Corporation, Inc.
4. Dynatrol 1; Pecora Corporation.
5. Vulkem 116; Tremco.
6. Chem-Calk 900; Bostik Findley.

B. Type 2 - General Purpose Exterior Sealant: Single-component, nonsag, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, for Use NT. Shall be no staining on granite, precast concrete and brick per ASTM C 1248.
1. Dow Corning Corporation; 795.
2. GE Advanced Materials - Silicones; SilPruf NB SCS9000.
3. Pecora Corporation; 864NST.
4. Tremco Incorporated; Spectrem 3.

C. Type 3 - General Purpose Interior Sealant: Acrylic emulsion latex; ASTM C834, single component, paintable.
1. Tremflex 834; Tremco.
2. AC-20; Pecora Corporation.
3. Chem-Calk 600; Bostik Findley.

D. Type 4 - Plumbing Fixture/Tile Sealant: Silicone; ASTM C920, Uses M and A; single component, mildew resistant, color selected by Architect.
1. 898 Silicone; Pecora Corporation.
2. Tremsil 200 Sanitary; Tremco, Inc.

E. Type 5 - Interior Floor Joint Sealant: Polyurethane, self-leveling; ASTM C920, Grade P, Class 25, Uses T, M and A; single component.
1. Sonolastic SL-1; Sonneborn, Division of ChemRex Inc.
2. Tremflex S/L; Tremco.
3. Sikaflex-1CSL; Sika Corporation, Inc.
4. NR-201; Pecora Corporation.
5. Vulkem 45; Tremco.
6. Chem-Calk 950; Bostik Findley.

F. Acoustical Sealant: See Division 09 Section "Gypsum Board Assemblies."

2.3 JOINT-SEALANT BACKING

A. General: Provide sealant backings (backer rods) of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Plastic Foam Joint Fillers (Backer Rods): ASTME C 1330, Type C, preformed, compressible, resilient, nonstaining, nonwaxing, nonextruding strips of flexible plastic foam of material indicated below and of size, shape, and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1. Closed-cell polyethylene foam, nonabsorbent to liquid water and gas, nonoutgassing in unruptured state.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.4 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean concrete, masonry, unglazed surfaces of ceramic tile, and similar porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles and dust remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air.
3. Remove laitance and form-release agents from concrete.
4. Clean metal, glass, porcelain enamel, glazed surfaces of ceramic tile, and other nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

B. Joint Priming: Prime joint substrates, where indicated or recommended in writing by joint-sealant manufacturer, based on prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
   1. Masonry and concrete surface shall be primed.

C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Installation of Sealant Backings (Backer Rods): Install sealant backings to comply with the following requirements:
   1. Install sealant backings of type indicated to provide support of sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
      a. Do not leave gaps between ends of sealant backings.
      b. Do not stretch, twist, puncture, or tear sealant backings.
   2. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and joint fillers or backs of joints.

D. Installation of Sealants: Install sealants using proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability. Install sealants at the same time sealant backings and primer are installed.
   1. Place sealants so they directly contact and fully wet joint substrates.
   2. Completely fill recesses in each joint configuration.
   3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
   1. Remove excess sealant from surfaces adjacent to joints.
   2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
   3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

3.4 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.6 JOINT-SEALANT SCHEDULE

A. Control, Expansion, and Soft Joints in Masonry and Between Masonry and Adjacent Work: Type 2; colors as selected. Prime masonry.

B. Joints between Exterior Metal Frames and Adjacent Work (except masonry): Type 2; colors as selected.

C. Under Exterior Door Thresholds: Type 1.

D. Exterior Joints for Which No Other Sealant Type is Indicated: Type 2; colors as selected.

E. Concealed Interior Perimeter Joints of Exterior Openings: Type 1.

F. Exposed Interior Perimeter Joints of Exterior Openings: Type 3; colors as selected.

G. Control and Expansion Joints in Concrete Slabs and Floors Left Exposed: Type 5; colors as selected.

H. Joints between Plumbing Fixtures and Walls and Floors and Between Countertops and Walls: Type 4; colors as selected.

I. Interior Joints for Which No Other Sealant is Indicated: Type 3; colors as selected.

END OF SECTION 079200

62 India Str
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Approved with Conditions
Date: 04/11/17

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Hollow metal doors and frames.
2. Hollow-metal frames with kerf for smoke seals and weather stripping.
3. Smoke seals and weather stripping gaskets for kerfed frames.

B. Related Sections:
1. Division 08 Section "Door Hardware" for door hardware for hollow metal doors.
2. Division 08 Section "Glazing" for glazed lights in hollow metal doors and borrowed-light frames.
3. Division 09 Sections "Painting" for field painting hollow metal doors and frames and steel frames with nailing flanges.
4. Division 26 Sections for electrical connections including conduit and wiring for door controls and operators.

1.3 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

B. Standard Hollow Metal Work: Hollow metal work fabricated according to ANSI/SDI A250.8.

1.4 SUBMITTALS

A. General: Submit in accordance with Division 01 Section "Submittal Procedures."
1. Submittals for Division 08 Sections "Hollow Metal Doors and Frames," "Wood Doors," "Exterior Clad Wood Doors," and "Door Hardware" shall be made concurrently.

B. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, fire-resistance rating, and finishes.

C. Shop Drawings: Include the following:
1. Elevations of each door design.
2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Provide dimensions for proper edge clearances of wood and metal doors, including meeting stiles for pairs of doors going into metal frames.
5. Locations of reinforcement and preparations for hardware.
6. Details and locations of smoke seals and weather stripping gaskets of frames.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

7. Details of each different wall opening condition.
8. Details of anchorages, joints, field splices, and connections.
9. Details of accessories.
10. Details of moldings, removable stops, and glazing.
11. Details of conduit and preparations for power, signal, and control systems.

D. Door Schedule: Provide a schedule of hollow metal doors and frames prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with door hardware schedule.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of hollow metal door and frame assembly.

F. Certificate: Provide certification that primed non-galvanized steel doors comply with ANSI A250.10 acceptance criteria and primer has a uniform dry film thickness of not less than 0.7 mils.

1.5 QUALITY ASSURANCE

A. Source Limitations for Hollow Metal Doors and Frames: Obtain hollow metal work from single source from single manufacturer.

B. Source Limitations for Steel Frames with Nailing Flange: Obtain steel frames with nailing flanges through one source from a single manufacturer.

C. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C (Positive pressure).
1. Smoke- and Draft-Control Assemblies: Provide an assembly with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.

D. Door Frame Inspection: Contractor with Installer shall inspect each door frame installation, checking frame for squareness, alignment, twist, and plumbness before installation of wallboard to assure proper fit of doors with correct clearances and operation without modification to the door. Frames that are out of tolerance shall be reinstalled to requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Inspect doors and frames on delivery for damage; notify shipper and supplier if damage is found. Minor damages may be repaired provided refinished items match new work and are acceptable to Architect. Remove and replace damaged items that cannot be repaired as directed.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

D. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch- high wood blocking. Do not store in a manner that traps excess humidity.
   1. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

1.7 PROJECT CONDITIONS

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

1.8 COORDINATION

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

B. Coordinate dimensions for proper edge clearances of wood and metal doors, including meeting stiles for pairs of doors installed in metal frames.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Hollow Metal Door and Frame Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Ceco Door Products; an Assa Abloy Group company.
   2. Curries Company; an Assa Abloy Group company.
   3. Steelcraft; an Ingersoll-Rand company.

B. Manufacturers of Steel Frames with Nailing Flanges: Provide the following products from Rediframe Products, a division of The Dunbarton Corporation:
   1. Fire Rated Doors: Kerf Rediframe with seals.

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 or A60 metallic coating.

D. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z coating designation; mill phosphatized.
   1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.

E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

F. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool with 6- to 12-lb/cu. ft. density; with maximum flame-spread and smoke-development indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

G. Glazing: Comply with requirements in Division 08 Section "Glazing."

2.3 HOLLOW METAL DOORS

A. General: Provide doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8, unless more stringent requirements are specified.
   1. Design: Flush panel.
   2. Core Construction: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core. Provide internal sound deadener on inside of face sheets.
      a. Fire Door Core: As required to provide fire-protection ratings indicated.
      b. Thermal-Rated (Insulated) Doors: Where indicated, provide doors fabricated with thermal-resistance value (R-value) of not less than 11.1 deg F x h x sq. ft./Btu when tested according to ASTM C 518, unless otherwise indicated.
         1) Locations: Exterior doors.
   3. Vertical Edges for Doors: Beveled edge.
      a. Beveled Edge: 1/8 inch in 2 inches.
   4. Top and Bottom Edges: Closed with flush or inverted 0.042-inch- thick, end closures or channels of same material as face sheets.
   5. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."

B. Exterior Doors (Including Covered Parking): Face sheets fabricated from metallic-coated steel sheet. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
   1. Level 3 and Physical Performance Level A (Extra Heavy Duty), 16 Gage, Model 2 (Seamless).

C. Interior Doors: Face sheets fabricated from cold-rolled steel sheet,. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
   1. Level 2 and Physical Performance Level B (Heavy Duty), 18 gage, Model 2 (Seamless).

D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcing plates of sufficient strength from same material as door face sheets to support hardware without through bolting and to comply with the following minimum sizes:
   1. Hinges: Minimum 0.123 inch thick, 10 gage, by 1-1/2 inches wide by 6 inches longer than hinge, secured by not less than 6 spot welds.
   2. Lock Face, Flush Bolts, Closers, and Concealed Holders: Minimum 0.067 inch thick, 8 gage.
   3. All Other Surface-Mounted Hardware: Minimum 0.067 inch thick, 8 gage.

E. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

2.4 HOLLOW METAL FRAMES

A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile. Conceal fastenings, unless otherwise indicated.

B. Exterior Frames (Including Covered Parking): Fabricated from metallic-coated steel sheet.
1. Fabricate frames with mitered or coped corners and seamless face joints.
2. Fabricate frames as full profile welded, unless otherwise indicated.
3. Frames shall have a kerf and weather stripping.
4. Frames for Level 3 Steel Doors: 0.053-inch- thick, 16 gage, steel sheet.

C. Interior Frames: Fabricated from cold-rolled steel sheet, unless metallic-coated sheet is indicated.
1. Fabricate frames with mitered or coped corners and seamless face joints.
2. Fabricate frames as face welded, unless otherwise indicated.
3. Frames shall have a kerf and smoke seals at fire rated doors.
4. Frames for Level 2 Steel Doors: 0.053-inch- thick, 16 gage, steel sheet.
5. All welded joints shall be ground and dressed to be smooth, flush, and invisible.

D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcement plates of sufficient strength from same material as frames to support hardware without through bolting and to comply with the following minimum sizes:
1. Hinges: Minimum 0.123 inch thick, 10 gage, by 1-1/2 inches wide by 6 inches longer than hinge, secured by not less than 6 spot welds.
2. Lock Face, Flush Bolts, Closers, and Concealed Holders: Minimum 0.067 inch thick, 14 gage.
3. All Other Surface-Mounted Hardware: Minimum 0.067 inch thick, 14 gage.
4. Fabricate concealed stiffeners and hardware reinforcement plates from same material as frames.
5. Locate hardware reinforcement plates as indicated on Shop Drawings or, if not indicated, according to ANSI/SDI A250.6.

2.5 FRAME ANCHORS

A. Jamb Anchors:
1. Stud-Wall Type: Slip in wood stud anchor; not less than 0.053 inch thick, 16 gage.

B. Floor Anchors: Formed from same material as frames, not less than 0.042 inch thick, 18 gage, and as follows:
1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at finish floor surface.

2.6 STEEL FRAMES WITH NAILING FLANGES

A. Steel Frames with Nailing Flanges to Receive Trim: Provide fixed throat steel frame with double rabbet profile with integral stops; having nailing flange on one or both sides; and having the following characteristics:
1. Interior Frames: Fabricated from cold-rolled steel sheet as follows:
a. Header and Jamb Members: Not less than 0.042 inch thick, 18 gage.

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

b. Fabrication: Knockdown.
c. Fire-Rated Frames: Provide where indicated with rating indicated.
1) Provide kerfed frame with integral smoke seals.
2) Coordinate width of frames to provide proper edge clearances for single and pairs of doors, and for compliance with fire ratings.

2. Hardware Reinforcement: As standard for manufacturer; reinforcing shall be same material as frame.
a. Provide kerf smoke seals for fire rated frames and silencers for interior non-fire rated frames.

2.7 STOPS AND MOLDINGS

A. Moldings for Glazed Lites in Doors: Minimum 0.032 inch thick, 22 gage, fabricated from same material as door face sheet in which they are installed.
1. Provide non-removable stops on outside of exterior doors and on secure side of interior doors for glass.
2. Provide screw-applied, removable, glazing stops on inside of glass.

B. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch high unless otherwise indicated.

C. Loose Stops for Glazed Lites in Frames: Minimum 0.032 inch thick, 22 gage, fabricated from same material as frames in which they are installed.

2.8 ACCESSORIES

A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

B. Smoke Seals for Fire-Rated Door Frames: UV-resistant polyethylene clad urethane foam gasket material complying with UL10C with 3 hour fire rating approval.

C. Weather Stripping for Exterior Door Frames: UV-resistant polyethylene clad urethane foam gasket material.

2.9 FABRICATION

A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.

C. Hollow Metal Doors:
1. Exterior Doors: For exterior locations and elsewhere as indicated, fabricate doors from metallic-coated steel sheet. Close top and bottom edges of doors flush as an integral part of door construction or by addition of 0.053-inch- thick, 16 gage, metallic-coated steel channels with channel webs placed even with top and bottom edges. Seal joints in top edges of doors against water penetration.
2. Interior Door Faces: Fabricate exposed faces of doors, including stiles and rails of nonflush units, from cold-rolled steel sheet, unless otherwise indicated.

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

3. Pairs of Doors: Size pairs of doors to provide the following maximum gap between leafs to permit proper functioning of dead latching feature:
   a. Rated Doors: Maximum 1/8-inch gap.
   b. Non-Rated Doors: Maximum 3/16-inch gap.
4. Glazed Lites: Factory cut openings in doors.
5. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.
6. Coordinate door undercut to provide 1/2 inch clearance from top of floor covering. Coordinate locations where tile floor coverings occur.

D. Hollow Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
   1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
   2. Sidelight Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
   3. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
   4. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor. Provide floor anchors for all frames. Floor anchors are in addition to jamb anchors.
   5. Jamb Anchors: Provide number and spacing of anchors as follows:
      a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
         1) Two anchors per jamb up to 60 inches high.
         2) Three anchors per jamb from 60 to 90 inches high.
         3) Four anchors per jamb from 90 to 120 inches high.
         4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
      b. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
         1) Three anchors per jamb up to 60 inches high.
         2) Four anchors per jamb from 60 to 90 inches high.
         3) Five anchors per jamb from 90 to 96 inches high.
         4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
         5) Two anchors per head for frames above 42 inches wide and mounted in metal-stud partitions.
   6. Weather Stripping and Smoke Seals: Fabricate frames with kerfed receiver of proper width and depth to secure flange of kerf-in seal. Miter seals at inside corners.
   7. Provide welded frames with temporary spreader bars for shipping. Shipping spreader bars to be removed before installation, with template jig used to properly square up and space jambs.

E. Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

F. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."
   1. Locate hardware as indicated on Shop Drawings, or if not indicated, according to ANSI/SDI A250.8.
   2. Reinforce doors and frames to receive nontemplated, mortised and surface-mounted door hardware. Through bolting will not be acceptable.
   3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
   4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

G. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
   1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow metal work.
   2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
   3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
   4. Provide loose stops and moldings on inside of hollow metal work.
   5. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

H. Astragals: As required by NFPA 80 to provide fire ratings indicated.

2.10 STEEL FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
   1. Apply primers to hollow metal doors and frames after assembly.
   2. All interior and exterior doors and frames shall be factory primed to assure proper preparation and bond of primer. Bare galvannealed or galvanized steel for field priming not permitted.

B. Comply with SSPC-PA1, "Paint Application Specification No. 1," for steel sheet finishes.

C. Metallic-Coated Steel Surface Preparation: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A 780.
   1. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

D. Steel Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning"; remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel; comply with SSPC-SP 3, "Power Tool Cleaning," or SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

E. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating. Apply a smooth coat of even consistency to provide a uniform dry film thickness of not less than 0.7 mils.
   1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.

C. If unacceptable conditions are encountered, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Review finish schedules and verify flooring thickness to permit frame to be set at proper elevation to maintain undercut clearance of factory fit wood and hollow metal doors, providing not less than 1/4 inch clearance from finish floor.

B. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

C. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness to the following tolerances:
   1. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
   2. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
   3. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
   4. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.

D. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

3.3 INSTALLATION

A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. Hollow Metal Frames: Install hollow metal frames for doors and sidelights, of size and profile indicated. Comply with ANSI/SDI A250.11.
   1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
      a. At fire-protection-rated openings, install frames according to NFPA 80.
      b. Install frames with removable glazing stops located on secure side of opening.
      c. Remove shipping straps at bottom of frames. Properly space frame using wood template that is full depth of frame and of proper spacing width during setting and anchoring of frames to maintain proper width, with frame plumb and square without twists. Remove temporary braces necessary for installation only after frames have been properly set and secured. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
      d. Set bottom of frames at required elevations to provide proper undercut clearance of factory fit doors.
      e. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
   2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors. Floor anchors are in addition to wall anchors.
   3. Stud Partitions: Attach wall anchors to studs with screws. Provide floor anchor at each jamb, in addition to wall anchors. Use galvanized fasteners at exterior locations.
   4. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
      a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
      b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
      c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
      d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

C. Adjustable Steel Frames and Frames with Nailing Flanges: Comply with manufacturer's written instruction.
   1. At fire-protection-rated openings, install frames according to NFPA 80.
   2. Attach nailing fins to studs with screws.

D. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
   1. Non-Fire-Rated Standard Steel Doors:
      a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
      b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
      c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.

2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
3. Smoke-Control Doors: Install doors according to NFPA 105.
4. Pairs of Doors: Install pairs of doors to provide the following maximum gap between leafs and accurate alignment of strike to permit proper functioning of dead latching feature:
   a. Rated Doors: Maximum 1/8-inch gap.
   b. Non-Rated Doors: Maximum 3/16-inch gap.

E. Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.
   1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow metal work immediately after installation.

C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

D. Metallic-Coated Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 081113

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

SECTION 081416 - WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Solid-core doors with wood-veneer faces.
2. Wood frames for prehung doors.
3. Factory finishing flush wood doors.
4. Factory fitting flush wood doors to frames and factory machining for hardware.
5. Factory glazing of wood doors with glazed openings.

B. Related Requirements:
1. Division 08 Section "Exterior Clad Wood Doors" for aluminum-clad wood doors.
2. Division 08 Section "Door Hardware" for hardware and templates, and door hardware preinstallation conference.

1.3 ACTION SUBMITTALS

A. General: Submit in accordance with Division 01 Section "Submittal Procedures."
1. Submittals for Division 08 Sections "Hollow Metal Doors and Frames," "Wood Doors," "Exterior Clad Wood Doors," and "Door Hardware" shall be made concurrently.

B. Product Data: For each type of door. Include details of core and edge construction and trim for openings. Include factory-finishing specifications.

C. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and the following:
1. Dimensions and locations of blocking.
2. Dimensions and locations of mortises and holes for hardware.
3. Dimensions and locations of cutouts.
4. Undercuts.
a. Verify tile locations for proper clearance of door bottoms and hardware.
5. Requirements for veneer matching.
6. Doors to be factory finished and finish requirements.
7. Fire-protection ratings for fire-rated doors.
8. Glass.

D. Door Schedule: Submit schedule of doors using same reference numbers for details and openings as those on Contract Drawings.

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

E. Samples:
1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish. For each wood species and transparent finish, provide set of three Samples showing typical range of color and grain to be expected in finished Work.

F. Preinstallation conference meeting notes.

1.4 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For special warranty.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Protect wood doors during transit, storage, and handling to prevent damage, soiling and deterioration. Comply with requirements of referenced standard, manufacturer's instructions, and recommendations of WDMA I.S.1, Appendix, "How to Store, Handle, Finish, Install and Maintain Wood Doors."
1. Package doors at factory prior to shipping.
2. Protect doors from extremes of heat and cold. Relative humidity shall not be less than 30 percent nor more than 60 percent.
3. Compare prefinished doors to approved finish sample upon delivery. Notify Architect if sample does not match.

C. Mark each door on bottom rail with opening number used on Shop Drawings.

1.6 PREINSTALLATION MEETING

A. Door Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to door installation including, but not limited to, the following:
1. Meet with Owner, Architect, door installer, hardware installer, door supplier and door manufacturer's representative. Provide 7 business days minimum advance notice to participants prior to convening preinstallation conference. Door preinstallation conference shall run concurrently with door hardware preinstallation conference.
2. Review methods and procedures related to door installation, including manufacturer's written instructions.
3. Review installation of fire doors, including hinge screw application to fire rated doors and requirements for door removal from frame if required after installation.
4. Review door swing and closer installation to permit maximum swing without binding at frame opening.
5. Review floor covering requirements to provide proper door undercut clearance.
6. Review fire rated door requirements regarding no field modifications to labeled doors.
7. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

maintaining ambient temperature and humidity conditions at occupancy levels during remainder of construction period.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
      b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.
   2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
   3. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Algoma Hardwoods, Inc.
   2. Eggers Industries.
   3. Marshfield Door Systems, Inc.
   4. VT Industries, Inc.

B. Source Limitations: Obtain flush wood doors from single manufacturer.

2.2 FLUSH WOOD DOORS, GENERAL

A. Quality Standard: In addition to requirements specified, comply with WDMA I.S.1-A, "Architectural Wood Flush Doors."

B. WDMA I.S.1-A Performance Grade: Standard Duty.

C. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C (positive pressure), Category A.
   1. Cores: Provide core specified or mineral core as needed to provide fire-protection rating indicated.
   2. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.

D. Particleboard-Core Doors:
   1. Particleboard: ANSI A208.1, Grade LD-1 or Grade LD-2.
   2. Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware.

E. Structural-Composite-Lumber-Core Doors: Glazed stile and rail doors.
   1. Structural Composite Lumber: WDMA I.S.10.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

a. Screw Withdrawal, Face: 700 lbf.
b. Screw Withdrawal, Edge: 400 lbf.

F. Mineral-Core Doors:
1. Core: Noncombustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection rating indicated.
2. Blocking: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated as needed to eliminate through-bolting hardware.
3. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.
a. Screw-Holding Capability: 550 lbf per WDMA T.M.-10.

2.3 VENEER-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Solid-Core Doors:
1. Grade: Premium, with Grade A faces.
2. Species: Select white birch.
3. Cut: Rotary cut.
4. Match between Veneer Leaves: Pleasing match.
5. Assembly of Veneer Leaves on Door Faces: Running match.
6. Match: Provide door faces of compatible color and grain for doors hung in same opening or separated only by mullions.
7. Exposed Vertical Edges: Same species as faces.
8. Core: Particleboard, except as noted otherwise.
a. Provide mineral cores for fire-protection rated doors.
b. Provide structural composite lumber cores for stile and rail configured doors.
9. Construction: Five plies. Stiles and rails are bonded to core, then entire unit is abrasive planed before veneering. Faces are bonded to core using a hot press. No substitutions.
10. WDMA I.S.1-A Performance Grade: Standard Duty.

2.4 WOOD DOOR FRAMES FOR PREHUNG DOORS

A. Construction:
1. Jamb: Minimum 3/4 inch thickness, primed finish over manufacturer's paint grade poplar or birch species.
2. Applied Stops: Minimum 1/2 inch high, 1-1/4 inch width.
3. Hinges, 4 inch by 4inch plain bearing, 0.123" gage, full mortise, standard weight, 5 knuckle hinges, three hinges per door leaf. Steel with US15, satin nickel finish. Balance of hardware specified in Division 08 Section "Door Hardware."

2.5 LIGHT FRAMES

A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads unless otherwise indicated.
1. Wood Species: Same species as door faces.
2. Profile: Flush beads of manufacturer's standard shape.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

2.6 GLAZING IN DOORS

A. Safety Glass for Non-Rated Doors: ASTM C 1048; Kind FT (fully tempered), Condition A (uncoated), Type I (transparent flat glass); Class 1(clear); Quality q3 (glazing select).
   1. Thickness: 6.0 mm (0.23 inch) thick minimum.
   2. Safety Glazing Labeling: Permanently mark glazing with certification label of the SGCC. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

2.7 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
   1. Comply with NFPA 80 requirements for fire-rated doors.
   2. Coordinate sizing of pairs of doors to provide the following maximum gap between leafs to permit proper functioning of dead latching feature:
      a. Non-Rated Doors: Maximum 3/16-inch gap.

B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, BHMA-156.115-W, and hardware templates.
   1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.

C. Openings: Factory cut and trim openings through doors.
   1. Light Openings: Trim openings with moldings of material and profile indicated.
   2. Glazing: Factory install glazing in doors.

2.8 FACTORY FINISHING

A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
   1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on bottom edges, edges of cutouts, and mortises.

B. Factory finish doors.

C. Transparent Finish:
   1. Grade: Custom.
   2. Finish: WDMA TR-6 catalyzed polyurethane.
   3. Staining: As selected by Architect from manufacturer's full range
   4. Sheen: Satin.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames, with Installer present, before hanging doors.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Hardware: For installation, see Division 08 Section "Door Hardware."
1. Hinges shall be shimmed with metal shims at each door to provide equal clearance at each jamb.
a. After hinges have been fastened to fire rated doors, do not permit removal and reinstallation of screws to fire rated door edge material.
2. Locks, exit devices, door closers and other hardware shall be installed in accordance with the manufacturer's instructions. Pilot holes of recommended size, for wood screws required to fasten hardware, shall be drilled by installing Contractor before screws are fastened to wood doors.

B. Installation Instructions: Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
1. Install fire-rated doors according to NFPA 80.

C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge. Coordinate pairs of doors to provide the following maximum gap between leafs and accurate alignment of strike to permit proper functioning of dead latching feature:
1. Rated Doors: Maximum 1/8-inch gap.
2. Non-Rated Doors: Maximum 3/16-inch gap.

D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 081416

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

SECTION 081420 - EXTERIOR CLAD WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes prehung, exterior aluminum-clad doors, sidelights and frames.

B. Related Sections:
1. Division 08 Section "Hollow Metal Doors and Frames" for exterior hollow metal doors and frames.
2. Division 08 Section "Wood Doors."

1.3 SUBMITTALS

A. General: Submit in accordance with Division 01 Section "Submittal Procedures."
1. Submittals for Division 08 Sections "Hollow Metal Doors and Frames," "Wood Doors," "Exterior Clad Wood Doors" and "Door Hardware" shall be made concurrently.

B. Product Data: For each type of product specified. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes. Include manufacturer's installation instructions.

C. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of opening; construction details, including those for stiles, rails, panels, moldings (sticking), glazing, finish requirements, and hardware.

D. Samples: Finish sample representing typical range of color and grain for each species required with same materials proposed for factory-finished components.

E. Sample Warranties: For manufacturer's warranties.

1.4 QUALITY ASSURANCE

A. Door Hardware Coordination: Door hardware not provided by clad wood door manufacturer shall be delivered by the door hardware supplier to the factory for verification of fit with all components and trial installation. Door hardware shall be packaged and returned with the door shipment to the project.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver doors and frames palletized, wrapped, or crated to provide protection of material and finish during transit and Project-site storage. Store under cover in dry location.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1.6 WARRANTY

A. Special Warranty for Aluminum-Clad Doors and Frames: Manufacturer's standard form in which manufacturer agrees to repair or replace exterior aluminum-clad doors and frames that fail in materials or workmanship within specified warranty period.
   1. Warranty Period for Doors: 10 years from date of Substantial Completion.
   2. Warranty Period for Insulating Glass: 20 years from date of Substantial Completion.
   3. Warranty Period for Aluminum-Cladding Finish: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 RESIDENTIAL EXTERIOR ALUMINUM-CLAD DOORS AND FRAMES

A. Exterior Aluminum-Clad Doors and Frames: Aluminum-clad, swinging, wood doors and frames for exterior locations.
   1. Interior Wood: Pine, with white factory finish.
   2. Exterior Finish: EnduraClad.
      a. Exterior Cladding Color: As indicated.
   3. Configuration: As indicated.
   4. Door Thickness: 1-3/4 inches.
   5. Panel Configuration: As selected by Architect.
   6. Top Rail Width: 4 inches.
   7. Bottom Rail Height: 8-7/16 inches.
   8. Glazing: Factory glazed; Low-e, argon filled, tempered, clear insulated glass units.
      a. Advanced Low-E IG.
         1) U-Factor 0.25.
   9. Performance:
      a. Class and Grade: LC50.
   10. Hardware Schedule: Coastal application. Satin nickel finish, except as indicated otherwise.
      a. Multi-point locking.
      b. Hinges: Adjustable hinge. US32D stainless steel.
      c. Threshold: Aluminum sill. Color as selected by Architect.
      d. Weather Stripping: Manufacturer's standard weather stripping. Color as selected by Architect.
   11. Accessories:
      a. Nailing fins.
      b. Clad Brickmold Casing: 3/1/2 inches wide.
   12. Products: Pella ProLine 450 Series.

B. Exterior Aluminum-Clad Doors and Frames: Aluminum-clad, sliding, wood doors and frames for exterior locations.
   1. Interior Wood: Pine, with white factory finish.
   2. Exterior Finish: EnduraClad.
      a. Exterior Cladding Color: As indicated.
   3. Configuration: Two- and panel doors.
   4. Door Thickness: 1-3/4 inches.
   5. Glazing: Factory glazed; Manufacturer's standard Low-e, argon filled, tempered, clear insulated glass units.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

a. Advanced Low-E IG.
   1) U-Factor 0.25.

6. Performance:
   a. Class and Grade: R50.
7. Hardware Schedule: Coastal application. Satin nickel finish, except as indicated otherwise.
   a. Two point locking.
   b. Stainless steel rollers.
   c. Threshold: Aluminum, low profile sill.
   d. Weather Stripping: Manufacturer's Standard weather stripping. Color as selected by Architect.
8. Accessories:
   a. Nailing fins.
   b. Standard Sliding Screen Door, finish to match door, with charcoal high transparency mesh. Coastal hardware.
   c. Clad Brickmold casing, 3/1/2 inches wide.
9. Products: Pella ProLine 450.

2.2 INSTALLATION MATERIALS

A. Polyurethane Foam Sealant (Minimal Expansive): Single- or two-component, UL classified sealant, to insulate, seal, fill, and stop air infiltration; shall not expand to the point to cause pressure on door jambs.
   1. Density: 1.2 lbs./cu. ft.
   2. R-Value: Not less than 4.0 per inch of thickness.
   3. Fire-Test-Response Characteristics: ASTM E 84, as follows:
      a. Flame Spread: 25.
      b. Smoke Developed: 50.
   4. Manufacturers:
      a. Dow Chemical Company (The); Great Stuff PRO Window & Door.
      b. Fomo Products Inc.; Handi-Seal Window and Door Sealant.
      c. Convenience Products; No-Warp Foam Window & Door Insulating Sealant.

B. Fiberglass Insulation: Unfaced glass fiber insulation, ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and substrates, with Installer present, for suitable conditions where doors and frames will be installed.
   1. Reject doors with damage defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

3.2 INSTALLATION

A. Install door frames level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment.
   1. Locate fasteners at concealed locations to the maximum extent possible. Countersink fasteners, fill surface flush.

B. Hardware: For installation, see Division 08 Section "Door Hardware."

C. Install doors to comply with manufacturer's written instructions, and other requirements specified.

D. Perimeter Insulation: Insulate the cavity between door frame and rough opening, with fiberglass insulation lightly stuffed from back side of trim/nailing fin, to within 1-inch of the interior face of door frame. Insulate between door frame and rough opening of the remaining void depth of approximately 1-inch with minimal expansive foam sealant.

E. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

END OF SECTION 081420

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

SECTION 083113 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Access doors and frames for walls and ceilings.

B. Related Requirements:
1. Division 23 Sections for heating and air-conditioning duct access doors.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Include construction details, fire ratings, materials, individual components and profiles, and finishes.

B. Shop Drawings:
1. Include plans, elevations, sections, details, and attachments to other work.
2. Detail fabrication and installation of access doors and frames for each type of substrate.

C. Product Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, fire-resistance rating as applicable, and other data pertinent to installation.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain access door(s) and frame(s) through one source from a single manufacturer.

B. Size Variations: Obtain Architect's acceptance of manufacturer's standard-size units, which may vary slightly from sizes indicated.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to access door and frame assemblies tested for fire-test-response characteristics according to the following test method and that are listed and labeled by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
1. NFPA 252 or UL 10B for fire-rated access door assemblies installed vertically.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

2. NFPA 288 for fire-rated access door assemblies installed horizontally.

2.2 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

A. Source Limitations: Obtain access doors and frames from single source from single manufacturer.

B. Flush Access Doors with Concealed Flanges for Gypsum Board Walls and Ceilings: Fabricated from steel sheet, except as noted. Provide stainless steel sheet for units in walls and ceilings within covered parking.
1. Assembly Description: Fabricate door to fit flush to frame. Provide frame with gypsum board beads for concealed flange installation.
2. Locations: Wall and ceiling.
3. Door Size: As indicated.
   a. Door Beneath Stairs Within Units: 24 inches by 36 inches.
4. Uncoated Steel Sheet for Door: Nominal 0.070 inch, 14 gage.
   a. Finish: Factory prime.
5. Stainless-Steel Sheet for Door: Nominal 0.062 inch, 16 gage.
   a. Finish: No. 4.
6. Frame Material: Same material and thickness as door.
7. Hinges: Concealed pin type or continuous piano hinge (stainless steel for stainless steel units).
8. Latch: Screwdriver- operated cam latch.
   a. Provide knurled knob turn with interior release for door beneath stairs within units
9. Lock: Key-operated cylinder lock in locations accessible by the public.
10. Products:
    a. J. L. Industries, Inc.; Model WB.
    b. Karp Associates, Inc.; KDW.
    c. The Williams Brothers Corporation of America; WB-DW.
    d. Provide comparable products where stainless steel units are indicated.

C. Fire-Rated, Flush Access Doors with Concealed Flanges for Gypsum Board : Fabricated from steel sheet, except as noted. Provide stainless steel sheet for units in covered parking.
1. Assembly Description: Fabricate door to fit flush to frame, with a core of mineral-fiber insulation enclosed in sheet metal. Provide self-latching door with automatic closer and interior latch release. Provide frame with gypsum board beads for concealed flange installation.
2. Locations: Wall and ceiling.
3. Fire-Resistance Rating: Not less than that of adjacent construction.
4. Uncoated Steel Sheet for Door: Nominal 0.040 inch, 20 gage.
   a. Finish: Factory prime.
5. Stainless-Steel Sheet for Door: Nominal 0.038 inch, 20 gage.
   a. Finish: No. 4.
6. Frame Material: Same material, thickness, and finish as door.
7. Hinges: Spring-loaded concealed pin type or continuous piano hinge (stainless steel for stainless steel units).
8. Latch: Screwdriver- operated cam latch.
9. Lock: Key-operated cylinder lock in locations accessible by the public.
10. Products:
    a. J. L. Industries, Inc.; FDWB.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

b. Karp Associates, Inc.; KRP-350 FR.
c. The Williams Brothers Corporation of America; WB-FR Standard for drywall.
d. Provide comparable products where stainless steel units are indicated.

2.3 MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A 879/A 879M, with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.

C. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304. Remove tool and die marks and stretch lines or blend into finish.

D. Frame Anchors: Same type as door face.

E. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

2.4 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access doors to types of supports indicated.
1. For concealed flanges with drywall bead, provide edge trim for gypsum board securely attached to perimeter of frames.
2. Provide mounting holes in frames for attachment of units to metal or wood framing.

D. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.
1. For cylinder locks, furnish two keys per lock and key all locks alike.

2.5 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

D. Steel Finishes:
   1. Factory Prime: Apply manufacturer's standard, fast-curing, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

E. Stainless-Steel Finishes:
   1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
   2. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
      a. Run grain of directional finishes with long dimension of each piece.
      b. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
      c. Directional Satin Finish: No. 4.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.

C. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.3 ADJUSTING

A. Adjust doors and hardware, after installation, for proper operation.

B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION 083113

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

SECTION 083323 - OVERHEAD COILING DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Electric-motor-operated high-usage overhead coiling doors.

B. Related Requirements:
   1. Section 055000 "Metal Fabrications" for miscellaneous steel supports.

1.3 ACTION SUBMITTALS

A. Product Data: For each type and size of overhead coiling door and accessory.
   1. Include construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.
   2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.
   3. Include description of automatic closing device and testing and resetting instructions.

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.
   1. Include plans, elevations, sections, and mounting details.
   2. Include details of equipment assemblies, and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
   3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
   4. Show locations of controls, , detectors and other accessories.
   5. Include diagrams for power, signal, and control wiring.

C. Samples: Manufacturer's finish charts showing full range of custom colors and available for units with factory-applied finishes.
   1. Include similar Samples of accessories involving color selection.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For overhead coiling doors to include in maintenance manuals.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1.5 QUALITY ASSURANCE

PART 2 - PRODUCTS

2.1 MANUFACTURERS, GENERAL

A. Source Limitations: Obtain overhead coiling doors from single source from single manufacturer.
   1. Obtain operators and controls from overhead coiling door manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Structural Performance, Exterior Doors: Capable of withstanding the design wind loads.
   1. Design Wind Load: Uniform pressure (velocity pressure) of 25 lbf/sq. ft., acting inward and outward.
   2. Testing: According to ASTM E 330.
   3. Deflection Limits: Design overhead coiling doors to withstand design wind load without evidencing permanent deformation or disengagement of door components.
   4. Operability under Wind Load: Design overhead coiling doors to remain operable under design wind load, acting inward and outward.

2.3 DOOR ASSEMBLY <Insert drawing designation>

A. Service Door: Overhead coiling door formed with curtain of interlocking metal slats.
   1. Cookson

B. Operation Cycles: Door components and operators capable of operating for not less than 100,000. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.
   1. Include tamperproof cycle counter.

C. Door Curtain Material: Galvanized steel.

D. Door Curtain Slats: Flat profile slats of 2-5/8-inch center-to-center height.

E. Bottom Bar: Two angles,; fabricated from hot-dip galvanized steel and finished to match door.

F. Curtain Jamb Guides: Galvanized steel with exposed finish matching curtain slats.

G. Hood: Match curtain material and finish.
   1. Shape: Round.
   2. Mounting: Face of wall.

H. Electric Door Operator:
   1. Usage Classification: Heavy duty, 25 or more cycles per hour and over 90 cycles per day.
   2. Operator Location: Front of hood.
   3. Safety: Listed according to UL 325 by a qualified testing agency for commercial or industrial use.
   4. Motor Exposure: Exterior, wet, and humid.
   5. Emergency Manual Operation: Chain type.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

6. Obstruction-Detection Device: Automatic infrared curtain or equal to detect vehicle presence.
7. Controls: Wireless remote.
   a. Include automatic closing timer with adjustable time delay before closing, tied into vehicle presence detector.

I. Door Finish:
1. Powder-Coated Finish: Custom color as selected by Architect.
   a. Cookson ColorCote.
2. Interior Curtain-Slat Facing: Match finish of exterior curtain-slat face.

2.4 MATERIALS, GENERAL

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.5 DOOR CURTAIN MATERIALS AND CONSTRUCTION

A. Door Curtains: Fabricate overhead coiling-door curtain of interlocking metal slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:
1. Steel Door Curtain Slats: Zinc-coated (galvanized), cold-rolled structural steel sheet; complying with ASTM A 653/A 653M, with G90 zinc coating; nominal sheet thickness (coated) of 20 gage; and as required.

B. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain, and a continuous bar for holding windlocks.

2.6 HOODS

A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods. Equip hood with intermediate support brackets as required to prevent sagging.
1. Galvanized Steel: Nominal 0.028-inch-thick, hot-dip galvanized steel sheet with G90 zinc coating, complying with ASTM A 653/A 653M.

2.7 LOCKING DEVICES

A. Chain Lock Keeper: Suitable for padlock to prevent unauthorized use of emergency chain operation.

2.8 COUNTERBALANCING MECHANISM

A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.

B. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. of span under full load.

C. Counterbalance Spring: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.
1. Cycles: 100,000.

D. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.9 ELECTRIC DOOR OPERATORS

A. General: Electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and operation-cycles requirement specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, control stations, control devices, integral gearing for locking door, and accessories required for proper operation.
1. Cookson SGH50.
2. Comply with NFPA 70.
3. Control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24-V ac or dc.

B. Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each door.

C. Door Operator Location(s): Operator location indicated for each door.
1. Front-of-Hood Mounted: Operator is mounted to the right or left door head plate with the operator on coil side of the door-hood assembly and connected to the door drive shaft with drive chain and sprockets. Front clearance is required for this type of mounting.

D. Motors: Continuous duty, reversible-type motor with controller (disconnect switch) for motor exposure indicated.
1. Electrical Characteristics:
   a. Phase: TBD.
   b. Volts: TBD V.
   c. Hertz: 60.
2. Motor Size: Minimum size as indicated. If not indicated, large enough to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec. and not more than 12 in./sec., without exceeding nameplate ratings or service factor.
3. Operating Controls, Controllers, Disconnect Switches, Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.
4. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

E. Limit Switches: Equip each motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.

F. Obstruction Detection Devices: External entrapment protection consisting of indicated automatic safety sensor capable of protecting full width of door opening.
   1. Infrared curtain, permitting full clearance of vehicles from the door zone.

G. Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.

H. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.

I. Portable Radio-Control System: Consisting of the following per door operator:
   1. Portable control devices to open and close door.
      a. Quantity: 30.
   2. Remote-antenna mounting kit.

2.10 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM/NOMMA's "Metal Finishes Manual for Architectural and Metal Products (AMP 500-06)" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.11 STEEL AND GALVANIZED-STEEL FINISHES

A. Powder-Coat Finish: Manufacturer's standard finish consisting of prime coat and thermosetting topcoat.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.

B. Examine locations of electrical connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

3.2 INSTALLATION

A. Install overhead coiling doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.

B. Install overhead coiling doors, hoods, controls, and operators at the mounting locations indicated for each door.

C. Power-Operated Doors: Install according to UL 325.

3.3 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.
   1. Perform installation and startup checks according to manufacturer's written instructions.
   2. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

3.4 ADJUSTING

A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.
   1. Adjust exterior doors and components to be weather-resistant.

B. Lubricate bearings and sliding parts as recommended by manufacturer.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling doors.

END OF SECTION 083323

62 India Str
Portland, M
DD

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

SECTION 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Exterior storefront framing.
2. Exterior manual-swing entrance doors and door-frame units.
3. Break metal in conjunction with frames.
4. Door hardware.
5. Preparation for door hardware provided by others.
6. Sealant at interior and exterior perimeter of storefront.

B. Related Requirements:
1. Division 07 Section "Joint Sealants" for installation requirements of joint sealants installed with aluminum-framed systems and for sealants to the extent not specified in this Section.
2. Division 08 Section "Glazing" for glazing requirements to the extent not specified in this Section.
3. Division 08 Section "Door Hardware" for Cylinders.

C. Products installed, but not furnished, under this Section include the following:
1. Balance of door hardware furnished in Division 08 Section "Door Hardware."

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site. Comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to glazed aluminum storefront and entrance systems including, but not limited to, the following:
1. Meet with Architect; storefront and entrance systems Installer; storefront and entrance systems manufacturer's representative; and installers whose work interfaces with or affects storefront and entrance systems.
2. Inspect and discuss condition of substrate and other preparatory work performed by other trades.
3. Review structural loading limitations.
4. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
5. Review required inspecting, testing, and certifying procedures.
6. Review weather and forecasted weather conditions and procedures for coping with unfavorable conditions.
7. Review temporary protection requirements for existing construction during and after installation.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

8. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.
9. Provide minimum advance notice of 7 business days to participants prior to convening preinstallation conference.

1.4 ACTION SUBMITTALS

A. General: Submit in accordance with Division 01 Section "Submittal Procedures."
   1. Submittals for Division 08 Sections "Hollow Metal Doors and Frames," "Wood Doors," "Aluminum-Framed Entrances and Storefronts," and "Door Hardware" shall be made concurrently.

B. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes. Include manufacturer's installation instructions for system specified.

C. Shop Drawings: For aluminum-framed entrances and storefronts prepared by or under the supervision of a qualified professional structural engineer. Include plans, elevations, sections, full-size details of components, rough openings, masonry openings, flashing and attachments to other work.
   1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
   2. Include full-size isometric details of each vertical-to-horizontal intersection of aluminum-framed entrances and storefronts, showing the following:
      a. Joinery, including concealed welds.
      b. Anchorage.
      c. Expansion provisions.
      d. Glazing.
      e. Flashing and drainage.
   3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
   4. For entrance doors, include hardware schedule and indicate operating hardware types, functions, quantities, and locations. Include required reinforcement to receive hardware.
   5. Indicate fastener layout and size for transferring loads back to supporting structure.

D. Samples for Initial Selection:
   1. Initial Selection of Sealant Color: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

E. Entrance Door Hardware Schedule: Prepared by or under supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.

F. Delegated-Design Submittal: For aluminum-framed entrances and storefronts indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional structural engineer responsible for their preparation.

62 India Str
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Inspections Division
Approved with Conditions
Date: 04/11/17

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
   1. Engineering Responsibility: Preparation of data for glazed aluminum storefront systems including the following:
      a. Shop Drawings based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Professional Engineer Qualifications: A professional structural engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of kind indicated. Engineering services are defined as those performed for installations of glazed storefront systems that are similar to those indicated for this Project in material, design, and extent.

C. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.
   1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of structural supports for aluminum-framed systems by field measurements before fabrication and indicate measurements on Shop Drawings.
   1. Coordinate rough opening, masonry opening, and wood blocking requirements.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of aluminum-framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including, but not limited to, excessive deflection.
      b. Failure of system to meet performance requirements.
      c. Noise or vibration created by wind and thermal and structural movements.
      d. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
      e. Adhesive or cohesive sealant failures.
      f. Water penetration through fixed glazing and framing areas.
      g. Failure of operating components.
      h. Glazing breakage.
   2. Warranty Period: Five years from date of Substantial Completion.

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Inspections Division
Approved with Conditions
Date: 04/11/17

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional structural engineer to design aluminum-framed entrances and storefronts.

B. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction. Aluminum-framed storefronts shall withstand the effects indicated and meet the requirements of IBC 2009.
   1. Aluminum-framed storefronts shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
   2. Failure also includes the following:
      a. Thermal stresses transferring to building structure.
      b. Deflection exceeding specified limits.
      c. Framing members transferring stresses, including those caused by thermal and structural movements to glazing.
      d. Glass breakage.
      e. Noise or vibration created by wind and thermal and structural movements.
      f. Loosening or weakening of fasteners, attachments, and other components.
      g. Failure of operating units.
      h. Sealant failure.

C. Structural Loads:
   1. Wind Loads: As indicated on Drawings.
   2. Other Design Loads: As indicated on Drawings.

D. Deflection of Framing Members: At design wind pressure, as follows:
   1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans up to 13 feet 6 inches and to 1/240 of clear span plus 1/4 inch for spans greater than 13 feet 6 inches or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.
   2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8 inch, whichever is smaller.
   3. Cantilever Deflection: Where framing members overhang an anchor point, as follows:
      a. Perpendicular to Plane of Wall: No greater than 1/240 of clear span plus 1/4 inch for spans greater than 11 feet 8-1/4 inches or 1/175 times span, for spans less than 11 feet 8-1/4 inches.

E. Structural: Test according to ASTM E 330 as follows:
   1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
   2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
   3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

F. Air Infiltration: Test according to ASTM E 283 for infiltration as follows:
   1. Fixed Framing and Glass Area:
      a. Maximum air leakage of 0.06 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft..
   2. Entrance Doors:
      a. Pair of Doors: Maximum air leakage of 1.0 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft.
      b. Single Doors: Maximum air leakage of 0.5 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft.

G. Water Penetration under Static Pressure: Test according to ASTM E 331 as follows:
   1. No evidence of water penetration through fixed glazing and framing areas when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft..

H. Condensation Resistance: Fixed glazing and framing areas shall have an NFRC-certified condensation resistance rating of no less than 62 as determined according to NFRC 500.

I. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:
   1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
   2. Thermal Cycling: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.
      a. High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of 180 deg F.
      b. Low Exterior Ambient-Air Temperature: 0 deg F.
      c. Interior Ambient-Air Temperature: 75 deg F.

2.2 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the following:
   1. Kawneer North America:
      a. Exterior Storefront and Entrances: Trifab 451T frames with 500 Wide Stile Entrances.
   2. Oldcastle Building Envelope (Formerly Vistawall):
      a. Exterior Storefront and Entrances: Series 3000 poured and debridged Thermal Storefront System with Wide Stile Entrances.
      b. .
   3. Tubelite:
      a. Exterior Storefront and Entrances: Exterior Storefront and Entrances: T14000 frames with Wide Stile Entrances.

B. Source Limitations: Obtain all components of aluminum-framed entrance and storefront system, including framing and entrance doors, from single manufacturer.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

2.3 FRAMING

A. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
   1. Construction: As follows:
      a. Exterior Framing Members: Composite assemblies of two separate extruded-aluminum components permanently bonded by an elastomeric material of low thermal conductance.
   2. Glazing System: Retained mechanically with gaskets on four sides.
   3. Glazing Plane: Center plane, exterior glazed.
   4. Finish: High-performance organic finish.
   5. Fabrication Method: Shear-block system.
   6. Provide components having face width indicated on Drawings.
   7. Provide thermally broken extruded aluminum sill flashing with end dams for storefront sills.
   8. Provide operable units (doors) manufactured by storefront system manufacturer.

B. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.

C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

D. Materials:
   1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
      a. Sheet and Plate: ASTM B 209.
      b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
      c. Extruded Structural Pipe and Tubes: ASTM B 429/B 429M.
      d. Structural Profiles: ASTM B 308/B 308M.
   2. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM, and prepare surfaces according to applicable SSPC standard.
      a. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
      b. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
      c. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.4 ENTRANCE DOOR SYSTEMS

A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual- and power-assisted-swing operation.
   1. Door Construction: 1-3/4-inch overall thickness, with minimum 0.125-inch- thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
   2. Door Design: Wide stile; 5-inch nominal width with 10-inch high bottom rail, and 6-inch cross rail.
   3. Door Frame: Minimum 0.188-inch thick, extruded aluminum; 1-3/4-inch by 4-1/2 inch profile, stop with weatherstripping; run jambs full height of opening and transom.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

4. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets; finished to match frame.
   a. Provide nonremovable glazing stops on outside of exterior doors and to nonsecured side of interior doors.

2.5 DOOR HARDWARE

A. General: Provide heavy-duty units in sizes, numbers, and types recommended by entrance system and hardware manufacturers for entrances and uses indicated. Finish exposed parts to match door finish, unless otherwise indicated. Provide specified manufacturers without substitution.
   1. Opening-Force Requirements:
      a. Egress Doors: Not more than 15 lbf to release the latch and not more than 30 lbf to set the door in motion and not more than 15 lbf to open the door to its minimum required width.

B. Heavy Weight, Ball-Bearing Hinges:
   1. Material: Stainless steel, including pin.
   2. Provide nonremovable pins (NRP) at hinges exposed to outside of exterior doors.
   3. Quantities:
      a. For doors with heights up to 87 inches, provide 3 hinges per leaf.
      b. For doors with heights of greater than 87 and up to 120 inches, provide 4 hinges per leaf.

C. Panic Exit Devices: BHMA A156.3, Grade 1, listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.
   1. Kawneer 1786 rim exit device. Cylinder dogging.

D. Cylinders: As specified in Section 087100 "Door Hardware."

E. Pulls: Equal to Kawneer Style CO-12, 10B.

F. Closers: BHMA A156.4, Grade 1, with accessories required for a complete installation, sized as required by door size, exposure to weather, and anticipated frequency of use; adjustable to comply with field conditions and requirements for opening force.
   1. LCN 4040 Series.

G. Weather Stripping: Manufacturer's standard replaceable components.
   1. Compression Type: Made of ASTM D 2000, molded neoprene, or ASTM D 2287, molded PVC. Provide at head and jamb of all exterior doors.

H. Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip. Provide at bottom of all exterior doors.

I. Thresholds: BHMA A156.21, raised thresholds beveled with a slope of not more than 1:2, with maximum height of 1/2 inch. Coordinate cutouts for operating hardware with anchors and jamb clips.
   1. Material: Aluminum, mill finish.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

J. Balance of Hardware: Furnished in Division 08 Section "Door Hardware."

2.6 GLAZING

A. Glazing: Specified in with Division 08 Section "Glazing."

B. Weatherseal Sealants: ASTM C 920 for Type S; Grade NS; Class 25; Uses NT, G, A, and O; chemically curing silicone formulation that is compatible with other system components with which it comes in contact; recommended by weatherseal-sealant and storefront manufacturers for this use.
1. Comply with installation requirements specified in Division 07 Section "Joint Sealants."
2. Color: As selected by Architect.

2.7 ACCESSORIES

A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
2. Reinforce members as required to receive fastener threads.
3. Do not use exposed fasteners, except for hardware application. For hardware application, use exposed fasteners with countersunk Phillips screw heads, finished to match framing. system or hardware being fastened, unless otherwise noted. Exposed fasteners shall be stainless steel.

B. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.
1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.

C. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

D. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.

E. Aluminum Break Metal: Form exposed flashing from sheet aluminum finished to match framing and of sufficient thickness, not less than 0.063-inch thick, to maintain a flat appearance without visible deflection.

F. Head Compensation Receptor (Deflection Track): Manufacturer's standard, thermally broken head receptor.

G. Framing Filler: Manufacturer's standard thermally broken, flat filler for framing members.

H. Base Adapter for Interior Storefront: Extruded aluminum tube, thermally broken, 4-1/2 by 4-1/2 inches.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

2.8 FABRICATION

A. General: Fabricate glazed aluminum storefront system according to approved Shop Drawings. Fabricate components that, when assembled, will have accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

B. Form or extrude aluminum shapes before finishing.

C. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

D. Fabricate components that, when assembled, have the following characteristics:
   1. Profiles that are sharp, straight, and free of defects or deformations.
   2. Accurately fitted joints with ends coped or mitered.
   3. Physical and thermal isolation of glazing from framing members.
   4. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.
   5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
   6. Provisions for field replacement of glazing from exterior for exterior entrances and storefront.
   7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

E. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

F. Storefront Framing: Fabricate components for assembly using shear-block system.

G. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
   1. Frames shall be one piece, full height of door opening.
   2. At exterior doors, provide compression weather stripping at fixed stops.
   3. At interior doors, provide silencers at stops to prevent metal-to-metal contact. Install three silencers on strike jamb of single-door frames and two silencers on head of frames for pairs of doors.

H. Entrance Doors: Reinforce doors as required for installing entrance door hardware.
   1. At exterior doors, provide weather sweeps applied to door bottoms and compression weather stripping at fixed stops.

I. Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.
   1. Install hardware for aluminum doors and entrances furnished in Section 087100 "Door Hardware."

J. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

2.9 ALUMINUM FINISHES

A. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
   1. Color: As indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
   1. Confirm that wood blocking, where used, has been sufficiently fastened to transfer storefront wind loads back to structure.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General:
   1. Comply with manufacturer's written instructions.
   2. Do not install damaged components.
   3. Fit joints to produce hairline joints free of burrs and distortion.
   4. Rigidly secure nonmovement joints.
   5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
   6. Seal perimeter and other joints watertight unless otherwise indicated.

B. Metal Protection:
   1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
   2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.

D. Set continuous sill members and flashing in full sealant bed as specified in Division 07 Section "Joint Sealants" to produce weathertight installation. Install sills in one piece, full width of opening except where opening exceeds available manufactured lengths. Provide sealed metal end dams at ends of sills. Sills shall turn up on backside to form pan, directing water to the exterior.

E. Install components plumb and true in alignment with established lines and grades.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

F. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.

G. Install glazing as specified in Division 08 Section "Glazing."

H. Install weatherseal sealant according installation requirements in Division 07 Section "Joint Sealants" and according to sealant manufacturer's written instructions to produce weatherproof joints. Install joint filler behind sealant as recommended by sealant manufacturer. Color of sealant to match aluminum finish.

I. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.
   1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
   2. Field-Installed Entrance Door Hardware: Install surface-mounted and concealed mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.
   3. Install hardware furnished in Division 08 Section "Door Hardware."

3.3 ERECTION TOLERANCES

A. Erection Tolerances: Install aluminum-framed entrances and storefronts to comply with the following maximum tolerances:
   1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
   2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
   3. Alignment:
      a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
      b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
      c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.
   4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

3.4 ENTRANCE DOOR HARDWARE SETS

HW Set AL-1

Single Entrance Doors
Each Opening Shall Have:
- 3 Hinges
- 1 Exit Device
- 1 Pull
- 1 Closer
- 1 Threshold
- 1 Set weatherstripping

Note: Cylinders furnished under Section 087100.

END OF SECTION 084113

62 India Str
Portland, I
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Inspections Division
Approved with Conditions
Date: 04/11/17

SECTION 085250 – ALUMINUM CLAD WOOD WINDOWS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following aluminum-clad wood-framed window product types:
   1. Double-hung windows.
   2. Fixed sash in frame windows.
   3. Extruded aluminum trim.

B. Related Sections include the following:
   1. Division 07 Section " Weather Barriers " for installing flexible flashing strip/transition strip over window flange and tying into weather barrier system.
   2. Division 09 Section "Painting" for transparent finish of interior of window unit.

1.3 DEFINITIONS

A. Performance grade number according to AAMA/WDMA 101/I.S.2/NAFS:
   1. Design pressure number in pounds force per square foot used to determine the structural test pressure and water test pressure.

B. Structural Test Pressure: For uniform load structural test, is equivalent to 150 percent of the design pressure.

C. Minimum Test Size: Smallest size permitted for performance class (gateway test size). Products must be tested at minimum test size or at a size larger than minimum test size to comply with requirements for performance class.

1.4 PERFORMANCE REQUIREMENTS

A. General: Provide wood windows capable of complying with performance requirements indicated, based on testing manufacturer's windows that are representative of those specified and that are of test size indicated below:
   1. Size indicated on Drawings.

1.5 SUBMITTALS

A. General: Submit in accordance with Division 01 Section "Submittal Procedures."

B. Product Data: Include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions for each type of wood window indicated.

62 India Str
Portland, I
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

C. Shop Drawings: Include plans, building elevations at 1/4-inch = 1 foot scale, unit elevations at 3/4-inch = 1 foot scale, sections and details at full scale, hardware, attachments to other Work, operational clearances, installation details, and the following:
   1. Mullion details, including reinforcement and stiffeners.
   2. Joinery details.
   3. Expansion provisions.
   4. Flashing and drainage details.
   5. Weather-stripping details.
   6. Glazing details.
   7. Extruded aluminum trim details.

D. Product Test Reports: Based on evaluation of comprehensive tests performed within the last four years by a qualified testing agency, for each type, class, grade, and size of window. Test results based on use of downsized test units will not be accepted.

E. Maintenance Data: For operable window sash, operating hardware, weather stripping, and finishes to include in maintenance manuals.

F. Warranty: Special warranty specified in this Section.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain clad wood windows through one source from a single manufacturer.

B. Product Options: Drawings indicate size, profiles, dimensional requirements, and aesthetic effects of wood windows and are based on the specific window type and system indicated. Refer to Division 01 Section "Product Requirements." Do not modify size and dimensional requirements.
   1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

C. Fenestration Standard: Comply with AAMA/WDMA 101/I.S.2/NAFS, "North American Fenestration Standard Voluntary Performance Specification for Windows, Skylights and Glass Doors," for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.

D. Glazing Publications: Comply with published recommendations of glass manufacturers and GANA's "Glazing Manual" unless more stringent requirements are indicated.

E. Insulating Glass Certification Program: Provide insulating glass units permanently marked on spacers or at least on one component pane of units with the appropriate certification label of the inspecting agency indicated below:
   1. Insulating Glass Certification Council (IGCC).
   2. Associated Laboratories, Inc. (ALI).
   3. National Certification Testing Laboratories (NCTL).

62 India Str
Portland, I
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to wood windows including, but not limited to, the following:
   1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   2. Review, discuss, and coordinate the interrelationship of wood windows with other exterior wall components. Include provisions for structural anchorage, glazing, flashing, tying into weather barrier system, weeping, sealants, and protection of finishes.
   3. Review and discuss the sequence of work required to construct a permanent watertight and weathertight exterior building envelope.
   4. Inspect and discuss the condition of substrate and other preparatory work performed by other trades.
   5. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.
   6. Provide 5 business days minimum advance notice to participants prior to convening preinstallation conference.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify wood window openings by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.8 WARRANTY

A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace wood windows that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:
   1. Failure to meet performance requirements.
   2. Structural failures including excessive deflection.
   3. Water leakage, air infiltration, or condensation.
   4. Faulty operation of movable sash and hardware.
   5. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
   6. Insulting glass failure.

C. Window Warranty Period: Five years from date of Substantial Completion.

D. Warranty Period for Glass: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the following:

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1. Aluminum-Clad Wood Windows:
   a. Pella Corporation; ProLine 450 Series.

2.2 MATERIALS, GENERAL

A. General: Comply with the requirements of AAMA/WDMA 101/I.S.2 and the more stringent requirements listed in this Article.

B. Wood: Clear ponderosa pine or another suitable fine-grained lumber; kiln-dried to a moisture content of 6 to 12 percent at time of fabrication; free of visible finger joints, blue stain, knots, pitch pockets, and surface checks larger than 1/32 inch deep by 2 inches wide; water-repellent preservative treated.
   1. Units designated to have interior natural finish shall be fabricated of solid lumber; no finger joints allowed.

C. Aluminum Extrusions and Rolled Aluminum for Cladding: Manufacturer's standard formed sheet or extruded-aluminum cladding, mechanically bonded to exterior exposed wood members. Provide aluminum alloy and temper recommended by wood window manufacturer for strength, corrosion resistance, and application of required finish, but not less than 22,000-psi ultimate tensile strength, and not less than 16,000-psi minimum yield strength.
   1. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
   2. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
   3. Finish: Manufacturer's standard baked enamel complying with AAMA 2603 and paint manufacturer's specifications for cleaning, conversion coating, and painting.
      a. EnduraClad.

D. Wood Trim and Glazing Stops: Material and finish to match frame members.
   1. Provide for interior side of windows.
   2. No interior exposed fasteners permitted.

E. Clad Trim and Glazing Stops for Aluminum Clad Windows: Hollow extrusions; material and finish to match clad frame members.
   1. Provide for exterior side of windows.
      a. 2 inch sill nose and brickmould. See “Accessories” article below.

F. Fasteners: Aluminum, nonmagnetic stainless steel, epoxy adhesive, or other materials warranted by manufacturer to be noncorrosive and compatible with wood window members, cladding, trim, hardware, anchors, and other components. Cadmium-plated steel fasteners are not permitted.
   1. Exposed Fasteners: Unless unavoidable for applying hardware, do not use exposed fasteners. For application of hardware, use fasteners that match finish of member or hardware being fastened, as appropriate.

G. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated. Cadmium-plated steel anchors, clips, and accessories are not permitted.

62 India Str
Portland, I
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

H. Reinforcing Members: Aluminum, nonmagnetic stainless steel, nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated. Cadmium-plated steel reinforcing members are not permitted.

I. Compression-Type Weather Stripping: Provide compressible weather stripping designed for permanently resilient sealing under bumper or wiper action, and completely concealed when wood window is closed.

2.3 WINDOW

A. Window Type: Double hung.

B. AAMA/WDMA Performance Requirements: Provide wood windows of performance indicated that comply with AAMA/WDMA 101/I.S.2/NAFS, unless more stringent performance requirements are indicated.
1. Performance Class and Grade: LC30.

C. Thermal Transmittance: Provide wood windows with a whole-window, U-factor maximum indicated at 15-mph exterior wind velocity and winter condition temperatures when tested according to NFRC 100.
1. U-Factor: 0.30 Btu/sq. ft. x h x deg F or less.

D. Solar Heat-Gain Coefficient (SHGC): Provide wood windows with a whole-window SHGC maximum of 0.30, determined according to NFRC 200 procedures.

E. Sound Transmission Class (STC): Provide glazed windows rated for not less than 25 STC when tested for laboratory sound transmission loss according to ASTM E 90 and determined by ASTM E 413.

F. OITC Sound Rating: Provide glazed windows rated for not less than 22.

2.4 GLAZING

A. Glass: Clear, insulating-glass units, argon gas filled, with low-E coating pyrolytic on second surface or sputtered on second or third surface
1. Advanced Low-E IG.

B. Glazing System: Manufacturer's standard factory-glazing system that produces weathertight seal.

2.5 HARDWARE

A. General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907, or other corrosion-resistant material compatible with wood and aluminum cladding; designed to smoothly operate, tightly close, and securely lock wood windows and sized to accommodate sash or ventilator weight and dimensions. Cadmium-plated hardware is not permitted. Do not use aluminum in frictional contact with other metals. Where exposed, provide solid white metal hardware with a special coating finish and plated steel or brass/bronze operating bars and rods.

62 India Str
Portland, I
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

B. Counterbalancing Mechanism: Comply with AAMA 902.
   1. Sash-Balance Type: Concealed spring-loaded, block-and-tackle type of size and capacity to hold sash stationary at any open position.

C. Locks and Latches for DoubleHung Units: Designed to allow unobstructed movement of the sash across adjacent sash in direction indicated and operated from the inside only. Units over 33-1/4 inches wide shall have two sash locks.
   1. Locks shall have integral tilt release mechanism permitting each sash to be tilted 90 degrees inward from a bottom pivot and positively held in place for washing.

2.6 INSECT SCREENS

A. General: Design windows and hardware to accommodate screens in a tight-fitting, removable arrangement, with a minimum of exposed fasteners and latches. Locate screens on outside of window. Provide for each operable exterior sash or ventilator.

B. Aluminum Insect Screen Frames: Manufacturer's standard aluminum alloy complying with SMA 1004. Fabricate frames with mitered or coped joints, concealed fasteners, and removable PVC spline/anchor concealing edge of frame.
   1. Finish: Match window members.

C. Glass-Fiber Mesh Fabric: 18-by-14 or 18-by-16 mesh of PVC-coated, glass-fiber threads; woven and fused to form a fabric mesh resistant to corrosion, shrinkage, stretch, impact damage, and weather deterioration in the following color. Comply with ASTM D 3656.
   1. Mesh Color: Charcoal gray.

2.7 ACCESSORIES

A. Aluminum Trim: Extruded aluminum, finish th match windows.
   1. Sills: 2 inch nose with nose extension.
   2. Perimeter Trim:
      a. Siding Areas: 3-1/2 inch Brickmould.
      b. Brick Surround: Brickmould.

B. Mullion Covers: One piece, extruded aluminum mullion covers.
   1. Provide vertical mullions one-piece without joints, full height of stacked window units.
   2. Provide horizontal mullions one-piece without joints, full width of mulled units, butting into vertical mullions.

C. Interior Mullion Covers: Clear ponderosa pine; mullion width x 3/8-inch with chamfered edges. Provide for all factory and field mullions.

D. Reinforcing: Steel or aluminum, as required by window manufacturer.

2.8 FABRICATION

A. General: Fabricate wood windows, in sizes indicated, that comply with requirements and that meet or exceed AAMA/WDMA 101/I.S.2/NAFS performance requirements for double-hung, windows with minimum LC30 rating. Include a complete system for assembling components and anchoring windows.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

B. Weather Stripping: Provide full-perimeter weather stripping for each operable sash and ventilator, unless otherwise indicated.

C. Factory machine windows for openings and hardware that is not surface applied.

D. Mullions: Provide mullions and cover plates as shown, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections, as indicated. Provide mullions and cover plates capable of withstanding design loads of window units.

E. Factory-Glazed Fabrication: Glaze wood windows in the factory. Comply with AAMA/WDMA 101/I.S.2/NAFS.

F. Glazing Stops: Provide glazing stops to match sash and ventilator frames.

G. Complete fabrication, assembly, mulling of units, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation. Allow for scribing, trimming, and fitting at Project site.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work. Verify rough opening dimensions, levelness of sill plate, and operational clearances. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure a coordinated, weathertight window installation.
1. Verify that rough openings are correct and sill plates are level.

B. Coordinate window installation with weather barrier membrane, wall flashings and other built-in components.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components; Drawings; and Shop Drawings.

B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction. Use sections of mullion cover to properly space and align window units when setting and fastening windows into rough opening.
1. Maintain alignment with adjacent work.
2. Secure assembly to framed openings without distortion.
3. Center window in opening, rest bottom on sill plate.
4. Leave adequate clearance for caulking around entire perimeter between jambs and masonry.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

5. Shim and block as required; check width at center to avoid "hourglass" or bowed out installation.

C. Set sill members in bed of sealant or with gaskets, as indicated, for weathertight construction.

D. Metal Protection: Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

E. Install vertical mullion covers one piece, full height units, terminated flush with outside of window frame.

3.3 ADJUSTING

A. Adjust operating sashes and ventilators, screens, hardware, and accessories for a tight fit at contact points and weather stripping for smooth operation and weathertight closure. Lubricate hardware and moving parts.

3.4 PROTECTION AND CLEANING

A. Protect window surfaces from contact with contaminating substances resulting from construction operations. In addition, monitor window surfaces adjacent to and below exterior concrete and masonry surfaces during construction for presence of dirt, scum, alkaline deposits, stains, or other contaminants. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written recommendations.

B. Clean exposed surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

C. Clean factory-glazed glass immediately after installing windows. Comply with manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels and clean surfaces.

D. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

END OF SECTION 085250

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

SECTION 086200 - UNIT SKYLIGHTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes factory-assembled unit skylights for installation in flat roof areas.
   1. Type: Curb mounted.
   2. Glazing: Impact acrylic.

B. Related Sections include the following:
   1. Division 06 Section "Rough Carpentry" for wood framing and blocking at unit skylights.
   2. Division 07 Section "Ethylene-Propylene-Diene-Monomer (EPDM) Roofing" for flashing at unit skylights.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Loads: Provide unit skylights, including glazing and anchorage, complying with the requirements of the following code and capable of withstanding the effects of the following design loads:
   1. Building Code: International Building Code, 2009 Edition.
   2. Snow Load: 46 psf.
   3. Negative Pressure (Uplift) Load: 28 psf.

B. Thermal Movements: Provide aluminum-framed systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures without causing any detrimental effects to the system or components. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 100 deg. F.

C. Fall Protection Safety: No dome breakage or total disengagement of glazing from the frame shall occur upon impact of minimum 775 ft. lbs. Units shall be designed to comply with the intent of OSHA fall protection regulations.

1.4 SUBMITTALS

A. General: Submit in accordance with Division 01 Section "Submittal Procedures."

B. Product Data: For unit skylights. Include construction details, material descriptions, dimensions of individual components and profiles, glazing light transmission values, thermal characteristics, and finishes.

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

C. Shop Drawings: For unit skylights. Include plans, elevations, sections, details, curbs and attachments to other Work.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain factory-assembled unit skylights through one source from a single manufacturer.

B. Fire-Test Response Characteristics of Plastic Glazing: Provide plastic glazing sheets identical to those tested for fire-exposure behavior per test method indicated below by a testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
   1. Self-Ignition Temperature: 650 deg F or greater for plastic sheets in thickness indicated when tested per ASTM D 1929.
   2. Smoke Production Characteristics: Comply with either requirement below:
      a. Smoke Density: 75 or less when tested per ASTM D 2843 on plastic sheets in thickness indicated for use.
   3. Relative-Burning Characteristics: Tested per ASTM D 635.
      a. Impact Acrylic Glazing: Class CC2, burning rate of 2.5 inches per minute or less for nominal thickness of 0.060 inch or thickness indicated for use.

1.6 WARRANTY

A. General: Special warranties specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of unit skylights that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:
   1. Uncontrolled water leakage.
   2. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
   3. Yellowing of acrylic glazing.
   4. Warranty Period: Two years from Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Wasco Products, Inc.; Sentinel Fall Protection Units as follows:
   1. Model DDSA-6060.

2.2 UNIT SKYLIGHTS

A. General: Factory-assembled units that include glazing, extruded-aluminum glazing retainers, gaskets, and inner frames and that are capable of withstanding design loads indicated.

B. Integral Curb: Self-flashing type.

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1. Height: 9 inches.
2. Insulation: Manufacturer's standard rigid or semirigid type

C. Impact Acrylic Glazing: ASTM D 4802, thermoformable, monolithic sheet, Category CC-2, Type UVA (formulated with UV absorber), Finish 1 (smooth or polished).
1. Double-Glazing Profile: Dome, approximately 25 percent rise].
   a. Outer Glazing Color: Colorless, transparent.
   b. Inner Glazing Color: White, translucent.

D. Glazing Gaskets: Manufacturer's standard.

E. Aluminum Components:
1. Sheets: ASTM B 209, alloy and temper to suit forming operations and finish requirements but with not less than the strength and durability of alclad alloy 3005-H25.
2. Extruded Shapes: ASTM B 221, alloy and temper to suit structural and finish requirements but with not less than the strength and durability of alloy 6063-T52.
3. Anodic Coating: Class II, clear anodic coating complying with AAMA 611.

F. Fasteners: Same metal as metal being fastened, nonmagnetic stainless steel, or other noncorrosive metal as recommended by manufacturer. Finish exposed fasteners to match material being fastened.
1. Where removal of exterior exposed fasteners might allow access to building, provide nonremovable fastener heads.

G. Condensation Control: Fabricate unit skylights with integral internal gutters and nonclogging weeps to collect and drain condensation to the exterior.

H. Thermal Break: Fabricate unit skylights with thermal barrier separating interior metal framing from materials exposed to outside temperature.

2.3 INSTALLATION MATERIALS

A. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic, nominally free of sulfur and containing no asbestos fibers, formulated for 15-mil dry film thickness per coating.

B. Mastic Sealant: Polyisobutylene; nonhardening, nonskinning, nondrying, nonmigrating sealant.

C. Elastomeric Sealant: ASTM C 920; Type S; Grade NS; Class 25; and Uses NT, G, A, and (as applicable to joint substrates indicated) O; recommended by unit skylight manufacturer and compatible with joint surfaces.

2.4 FABRICATION

A. General: Form shapes with sharp profiles, straight and free of defects or deformations, before finishing. Factory fit and assemble (where practical), piece marked and shipped knocked down for final assemble at the jobsite.

B. Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads. Components, when assembled, shall have accurately fitted joints with ends coped or mitered to produce hairline joints free of

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

burrs and distortion. Fabricate components to accommodate expansion, contraction, and field adjustment, and to provide for minimum clearance and shimming at skylight perimeter. Fabricate components to ensure that glazing is thermally and physically isolated from framing members.

C. Welding: Shall be by the heliarc process.

D. Frame Weep System: Fabricate components to drain water passing joints and to drain condensation and moisture occurring or migrating within skylight system to the exterior.

E. Glazing: Provide extruded elastomeric setting blocks and spacers located and sized in accordance with the glazing manufacturer's recommendations. Prevent glazing from coming in contact with skylight frame or fasteners.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

3.2 INSTALLATION

A. General: Comply with manufacturer's instructions and recommendations.

B. Coordinate unit skylight installation with installation of substrates, vapor retarders, roof insulation, roofing, and flashing as required to ensure that each element of the Work performs properly and that combined elements are waterproof and weathertight.
   1. Unless otherwise indicated, install unit skylights according to construction details of NRCA's "The NRCA Roofing and Waterproofing Manual."

C. Where metal surfaces of units will contact incompatible metal or corrosive substrates, including wood, apply bituminous coating on concealed metal surfaces, or provide other permanent separation recommended in writing by unit skylight manufacturer.

D. Anchor unit skylights securely to supporting substrates, adequate to withstand lateral and thermal stresses as well as inward and outward loading pressures.

E. Flange Seals: Except as otherwise indicated, set unit skylight flanges in thick bed of roofing cement to form a seal, unless otherwise indicated.

F. Cap Flashing: Where cap flashing is indicated, install to produce waterproof overlap with roofing or roof flashing (counterflashing). Seal with thick bead of mastic sealant except where overlap is indicated to be left open for ventilation.

3.3 CLEANING

A. Clean exposed surfaces according to manufacturer's written instructions. Touch up damaged metal coatings.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1. Operating Units: Clean and lubricate joints and hardware. Adjust for proper operation.

B. Clean and polish skylight units, inside and out, not more than 5 days prior to date of Substantial Completion.

END OF SECTION 086200

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Commercial door hardware for the following:
      a. Swinging doors.
   2. Cylinders for doors specified in other Sections.
   3. Electrified door hardware.
   4. On site inspection of installed hardware, including proper installation of closers for degree of swing.
   5. Job site meeting for locating magnetic hold open devices.
   6. At electrified hardwired locks , provide the low voltage wiring and terminations within the door from the hinge to the lock.
   7. At doors with local power supplies, provide the low voltage wire and connections from the power supply to the electric strikes and magnetic lock. Run automatic door operator low voltage wiring from the access control interface module to the power supply for connection with the access control wiring. Coordinate power supply connection points with fire alarm installer and access control system installer for proper termination of alarm and control wiring in the power supply.

B. Related Sections include the following:
   1. Division 08 Section "Hollow Metal Doors and Frames" for kerf weatherstripping and smoke seals provided as part of the frame.
   2. Division 08 Section "Wood Doors" for astragals provided as part of a fire-rated labeled assembly.
   3. Division 08 Section "Exterior Clad Wood Doors"; work requiring hardware coordination.

1.3 SUBMITTALS

A. General: Submit in accordance with Division 01 Section "Submittal Procedures."
   1. Submittals for Division 08 Sections "Hollow Metal Doors and Frames," "Wood Doors," "Exterior Clad Wood Doors," and "Door Hardware" shall be made concurrently.

B. Product Data: For each product specified. Include installation details, material descriptions, dimensions of individual components and profiles, and finishes.

C. Shop Drawings: Details of electrified door hardware, indicating the following:
   1. Wiring Diagrams: Detail wiring for power, signal, and control systems and differentiate between manufacturer-installed and field-installed wiring. Include the following:
      a. System schematic.
   2. Detail interface between electrified door hardware and fire alarm system.

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

D. Samples: For exposed door hardware of each type indicated below, in specified finish, full size. Tag with full description for coordination with the Door Hardware Schedule. Submit samples before, or concurrent with, submission of the final Door Hardware Schedule.
   1. As requested by Architect.
   2. Samples will be returned to Contractor. Units that are acceptable and remain undamaged through submittal, review, and field comparison process may, after final check of operation, be incorporated into the Work, within limitations of keying requirements.

E. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
   1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
   2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening.
      a. Organize door hardware sets in same order as in the Door Hardware Schedule at the end of Part 3.
   3. Content: Include the following information:
      a. Type, style, function, size, label, hand, and finish of each door hardware item.
      b. Manufacturer of each item.
      c. Fastenings and other pertinent information.
      d. Location of each door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
      e. Explanation of abbreviations, symbols, and codes contained in schedule.
      f. Mounting locations for door hardware.
      g. Door and frame sizes and materials.
      h. Description of each electrified door hardware function, including location .
      i. Provide hardware for every door in the project, except as indicated, so that each door functions correctly for its intended use. Where a door is not included in the Door Hardware Schedule at end of Part 3, provide hardware scheduled for similar type opening and review with Architect.
   4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

F. Pre-Order Meeting Minutes: Record meeting notes regarding coordination, modifications and changes.

G. Inspection Report: Record notes regarding coordination, modifications and changes required during inspection of completed hardware installation.

H. Keying Schedule: Meet directly with the Owner to review hardware function and keying requirements. Prepare keying schedule by or under the supervision of supplier, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations.

I. Qualification Data: For firms and persons specified in "Quality Assurance" Article.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1. Include lists of completed projects with project names and addresses of architects and owners, and other information specified.

J. Maintenance Data: For each type of door hardware to include in maintenance manuals specified in Division 01Section "Operation and Maintenance Data."

K. Warranties: Special warranties specified in this Section.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Supplier Qualifications: Door hardware supplier with warehousing facilities in Project's vicinity and who is or employs a qualified Architectural Hardware Consultant, available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.
1. Scheduling Responsibility: Preparation of door hardware and keying schedules.

C. Architectural Hardware Consultant Qualifications: A person who is currently certified by the Door and Hardware Institute as an Architectural Hardware Consultant and who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project.
1. Architectural hardware consultant shall be a full time employee of the hardware supplier, shall be located within 2 hours driving time of the project site, and participate in job site meetings, keying and hardware function reviews, coordination and field examination of installed hardware.

D. Source Limitations: Obtain each type and variety of door hardware from a single manufacturer, unless otherwise indicated.

E. Pre-Ordering Meeting: Before ordering hardware, have a meeting with the Contractor, Owner and Architect to review hardware functions, door swing clearances and closer requirements, requirements and conflicts with hold open devices, electronic locking, door stops and other similar hardware requirements affecting the use and operation of each opening.
1. Prepare a list of questions and potential conflicts and distribute to the Architect 5 days before the meeting.
2. Shop drawings, including door and frame shop drawings and door hardware schedule shall be furnished to the Architect at least 10 days before the meeting.
3. Review each door on the project and record meeting notes regarding any coordination, modifications and changes. Submit meeting minutes within 3 days of meeting date.

F. Conditions and Coordination: Hardware supplier shall determine conditions and materials of doors and frames for proper application of hardware.
1. The Hardware Schedule shall list the actual product series numbers. Hardware supplier shall follow manufacturers' catalog requirement for the actual size of door closers, brackets and holders. Door opening sizes are as noted on the Door and Frame Schedule and hardware shall be in strict accordance with requirements of height, width, and thickness.

G. Regulatory Requirements: Comply with provisions of the following:

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1. Comply with all applicable codes. Comply with Americans with Disabilities Act (ADA), as follows:
   a. Handles, Pulls, Latches, Locks, and other Operating Devices: Shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist.
      1) Operable parts of such hardware shall be 34 inches minimum and 48 inches maximum above the finish floor or ground.
   b. Door Closers: Comply with the following maximum opening-force requirements indicated:
      1) Interior Hinged Doors: 5 lbf applied perpendicular to door.
      2) Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
   c. Thresholds: Not more than 1/2 inch high. Bevel raised thresholds with a slope of not more than 1:2.
2. NFPA 101: Comply with the following for means of egress doors:
   a. Latches, Locks, and Exit Devices: Not more than 15 lbf to release the latch. Locks shall not require the use of a key, tool, or special knowledge for operation.
   b. Door Closers - Exterior Doors: Not more than 30 lbf to set door in motion and not more than 15 lbf to open door to minimum required width.
3. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

H. Fire-Rated Door Assemblies: Provide door hardware for assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing at positive pressure according to NFPA 252.
   1. Test Pressure: After 5 minutes into the test, neutral pressure level in furnace shall be established at 40 inches or less above the sill (Positive pressure).

I. Keying Conference: Conduct conference directly with the Owner. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including, but not limited to, the following:
   1. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
   2. Requirements for key control system.
   3. Address for delivery of keys.

J. Preinstallation Conference: Conduct conference at Project site with hardware supplier, hardware installer, electrical subcontractor, and access control vendor to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to door hardware including, but not limited to, the following:
   1. Inspect and discuss electrical roughing-in and other preparatory work performed by other trades.
   2. Review sequence of operation for each type of electrified door hardware.
   3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   4. Review required testing, inspecting, and certifying procedures.
   5. Review proper installation procedures for locksets, exit devices and closers with Installer and Hardware Supplier.
   6. Coordinate on site inspection of installed hardware, including proper installation of closers for degree of swing, allowing doors to open to door stops without binding.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1.5 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver keys to Owner by registered mail or overnight package service.

1.6 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

B. Electrical System Roughing-in: Coordinate layout and installation of electrified door hardware with connections to power supplies, fire alarm system, and access control system.

1.7 WARRANTY

A. General Warranty: Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Special Warranty: Written warranty, executed by manufacturer agreeing to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:
   1. Structural failures including excessive deflection, cracking, or breakage.
   2. Faulty operation of operators.
   3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

C. Warranty Period for Manual Closers: 10 years from date of Substantial Completion.

D. Warranty Period for Exit Devices: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in this Section, and the Door Hardware Schedule at the end of Part 3.
   1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and named manufacturer's products.
   2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.

B. Designations: Requirements for function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Schedule at the end of Part 3.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

2.2 HINGES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Hinges:
      a. Hager Companies.
      b. McKinney Products Company; Div. of ESSEX Industries, Inc.
      c. Stanley Commercial Hardware; Div. of The Stanley Works.

B. Standards: Comply with the following:
   1. Butts and Hinges: BHMA A156.1.
   2. Template Hinge Dimensions: BHMA A156.7.
   3. Self-Closing Hinges and Pivots: BHMA A156.17.

C. Quantity: Provide the following, unless otherwise indicated:
   1. Two Hinges: For doors with heights up to 60 inches.
   2. Three Hinges: For doors with heights 61 to 90 inches.
   3. Four Hinges: For doors with heights 91 to 120 inches.
   4. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.
   5. Self-Closing Hinges: Provide two spring hinges per door leaf, with balance of hinges ball bearing type.

D. Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:

Maximum Door Size (inches)	Hinge Height (inches)	Metal Thickness (inches) Standard Weight	Heavy Weight
40 and under by 1-3/4	4-1/2	0.134	0.180
Over 40 by 1-3/4	5		0.190

E. Hinge Weight: Unless otherwise indicated, provide the following:
   1. Entrance Doors: Heavy-weight hinges.
   2. Interior Doors with Closers: Antifriction-bearing hinges.
   3. Interior Doors:
      a. General: Standard-weight hinges, oil-impregnated bearings unless specified otherwise.
      b. Interior doors at Stairs, Entry/Vestibules: Shall be heavy weight hinges.

F. Hinge Base Metal: Unless otherwise indicated, provide the following:
   1. Exterior Hinges: Bronze, brass or stainless steel, with stainless-steel pin. US 15 satin nickel.
   2. Interior Hinges: Steel, with steel pin..
   3. Hinges for Fire-Rated Assemblies: Steel, with steel pin.

G. Hinge Options: Comply with the following:
   1. Nonremovable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the following applications:

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

a. Outswinging exterior doors.
b. Outswinging interior doors with locks.

2. Corners: Square.

H. Fasteners: Comply with the following:
1. Machine Screws: For metal doors and frames. Install into drilled and tapped holes.
2. Threaded-to-the-Head Wood Screws: For fire-rated wood doors.
3. Screws: Phillips flat-head screws; machine screws (drilled and tapped holes) for metal doors. Finish screw heads to match surface of hinges.
4. Stainless steel for stainless steel hinges and exterior hinges.

2.3 LOCKS AND LATCHES

A. Bored Locks: BHMA A156.2, Grade 1 and Grade 2; Series 4000.
1. Unit Interior: YH collection, Valdosta lever cylindrical lock and latch sets.
2. Unit Entry: YH collection, Function 851, Interconnected single point lock. Latchbolt is operated by either lever at all times. Deadbolt activated by key on outside, by thumbturn on inside. Interior lever retracts latchbolt and deadbolt simultaneously.
1) Provide square interior, Valdosta lever.
2) ANSI/BHMA 619; US15 Brushed Nickel finish.
3) Provide cylinder with 6 pin Para Keyway. Coordinate keying of residential and commercial hardware to permit common master keying.
3. Public Locations Where Scheduled: 5400LN Series cylindrical lock and latchsets where scheduled. Monroe (MO) lever.
a. Provide cylinder with 6 pin Para Keyway.
4. ANSI/BHMA 699; US15 Brushed Nickel finish.

B. Lock Trim: Comply with the following:
1. Lever: Cast.
2. Escutcheon (Rose): Wrought.

C. Lock Throw: Comply with testing requirements for length of bolts to comply with labeled fire door requirements, and as follows:
1. Minimum 1/2-inch latchbolt throw.
2. Deadbolts: Minimum 1-inch bolt throw.

D. Backset: 2-3/4 inches, unless otherwise indicated.

E. Magnetic Locks:
1. Magnetic Lock: Securitron M670 Series; 1100 pound holding force; inswing bracket; satin aluminum finish; power supply.

2.4 DOOR BOLTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flush Bolts:
a. Door Controls International.
b. Glynn-Johnson; an Ingersoll-Rand Company .
c. Ives: H. B. Ives.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

d. Rixson-Firemark, Inc.; Div. of Yale Security Inc.
e. Rockwood Manufacturing Company.

B. Standards: Comply with the following:
1. Automatic and Self-Latching Flush Bolts: BHMA A156.3.

C. Automatic Flush Bolts: BHMA Grade 1, designed for mortising into door edge.

D. Bolt Throw: Comply with testing requirements for length of bolts to comply with labeled fire door requirements, and as follows:
1. Mortise Flush Bolts: Minimum 3/4-inch throw.

E. Strikes: Provide matching strikes for heads of doors. Provide dust proof strikes at all floor locations.

2.5 EXIT DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Stanley Precision Hardware, Inc.; Apex Series.
2. Sargent Manufacturing Company; 80 Series.
3. Von Duprin; 98 Series.
4. At electric rooms, provide (Precision)Apex Series, Sargent 30 Series, or Von Duprin 22 Series.

B. Panic Exit Devices: Listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.
1. For interior door configurations requiring vertical rod exit devices, provide less bottom rod .
2. Exit devices shall have US 15D finish, 32D if nickel finish is not available from the manufacturer. Exit devices in electric rooms shall have powder coat finish.

C. Fire Exit Devices: Complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire and panic protection, based on testing according to UL 305 and NFPA 252.

D. Outside Trim: Lever with cylinder; Cylinder at doors scheduled to receive pulls; material and finish to match locksets, unless otherwise indicated.
1. Match lever design to 5400 Series Monroe locksets and latchsets to the closest extent possible, unless otherwise indicated.

2.6 POWER SUPPLIES

A. Boxed Power Supply: Securitron BPS-24, UL Class 2 listed continuous duty boxed power supply, UL listed fire alarm release, sized for number of outputs, output voltage and inputs for interface with access control system and electrified hardware.
1. Provide battery backup, sized for the power supply current draw to provide a minimum of 2 hour backup time.
2. LED indication (AC and DC) showing power supply status.
3. Line voltage and DC fuses.
4. Lockable cover.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

B. Low Voltage Wire: Size, type and configuration for the equipment, distance and connections required. Provide wiring from the power supplies to the electrified hardware, and from the automatic door operator interface, to assure proper interface and connections of the controller with the access control and fire alarm systems to the exit device.

2.7 CYLINDERS AND KEYING

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following, :

B. Manufacturers: Subject to compliance with requirements, provide products by the following:
1. Cylinders: Provide for exit devices. Shall be Yale with 6 pin Para Keyway. Coordinate keying of residential and commercial hardware to permit common master keying.
2. Key Control Systems:
   a. Key Control Systems, Inc.
   b. Sargent Manufacturing Company; Div. of ESSEX Industries, Inc.
   c. Sunroc Corporation.
   d. Lund.

C. Standards: Comply with the following:
1. Cylinders: BHMA A156.5.
2. Key Control System: BHMA A156.5.

D. Cylinder Grade: BHMA Grade 1.

E. Cylinder Finish: Match hardware receiving cylinder.

F. Keying System: Unless otherwise indicated, provide a factory-registered keying system complying with the following requirements:
1. Key commercial and residential keying utilizing 6 pin Para Keyway to permit same master keying throughout facility. Coordinate through Yale tech services.
   a. Provide BK - Builder Key for access during construction that is is canceled by use of permanent key.
2. Master Key and/or Grand Master Key System: Cylinders are operated by a change key, a master key, and a grand master key.
3. Master Keys shall be sent to the Owner by registered mail, return receipt required.
4. Furnish manufacturer’s job number to Architect and Owner.

G. Keys: Provide nickel-silver keys complying with the following:
1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:
   a. Notation: "DO NOT DUPLICATE."
2. Quantity: In addition to one extra blank key for each lock, provide the following:
   a. 4 keys per lock with a maximum of 8 keys per keyed alike set.
   b. 4 keys each change keyed differently.
   c. 10 construction Builder Keys.
   d. 6 new Masterkeys.

H. Key Control System: BHMA Grade 1 system, including key-holding hooks, labels, two sets of key tags with self-locking key holders, key-gathering envelopes, and temporary and permanent markers. Contain system in metal cabinet with baked-enamel finish.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1. Each key shall be fully cut, indexed, tagged and installed on cabinet hooks by the key cabinet supplier and shipped with the locks. Provide 3-way cross index system referencing the (1) permanent room number, (2) key symbol: (3) bitting number set up by key control manufacturer and place keys on markers and hooks in the cabinet as determined by the final key schedule. Identify each key. Provide a red tag for each key and mark this tag "DO NOT REMOVE." Attach to one (each differently numbered) key and place it first in the key cabinet. Using white tags, place the remaining 4 like keys on the same hook. Provide 4 copies of chart showing hook number, key number, the location or room the key opens and the key cut. One chart to be a permanent part of the key cabinet. Turn over the other 3 to Owner's locksmith.
2. Wall-Mounted Cabinet: Cabinet with hinged-panel door equipped with key-holding panels and pin-tumbler cylinder door lock.
3. Capacity: Able to hold keys for 150 percent of the number of locks.

2.8 STRIKES

A. Manufacturers: Same manufacturer as lock, latch and device bolt engaging into strike.

B. Standards: Comply with the following:
1. Strikes for Cylindrical Locks and Latches: BHMA A156.13.
2. Strikes for Deadlocks: BHMA A156.5.

C. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated.

D. Electric Strike: 12V DC, BHMA Grade 1 strike. Provide all strikes with SMART Pac III accessory in-line power control, bridge rectifier, surge protection. 630 satin stainless finish.
1. Rim Exit Device Strike: Hes 9600 series Genesis III.
2. Cylindrical Lockset Strike: Hes 7000.

2.9 OPERATING TRIM

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Burns Manufacturing Incorporated.
2. NT Quality Hardware; an Ingersoll-Rand Company.
3. Rockwood Manufacturing Company.

B. Standard: Comply with BHMA A156.6, solid bar.

C. Materials: Fabricate from stainless steel, unless otherwise indicated.

1. Push-Pull Design: Door Pulls: 1inch diameter by 10 inches long. Concealed mounting. Rockwood 111
2. Push/Pull Bars: 1inch diameter. BB concealed mounting. Rockwood BF11147 x T1006 Mounting

2.10 ACCESSORIES FOR PAIRS OF DOORS

A. Standards: Comply with the following:
1. Coordinators: BHMA A156.3, Type #21

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

a. Shall be provided at all pairs of label doors equipped with overlapping astragals or where improper closing sequence would interfere with proper operating of doors.
b. Furnish filler pieces to close opening between coordinator and jamb of frame. Provide mounting brackets as required for proper mounting of additional hardware.
c. Models: Hager 297D, Door Controls 600 Series, Glynn Johnson Series "COR", or Rockwood 1600 Series.

2.11 CLOSERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Surface-Mounted Closers: For use at Exterior Entrances, Vestibule, Lobby, Stairs
a. LCN Closers; an Ingersoll-Rand Company); 4000 Series.
b. Sargent; 281 Series.
2. Surface-Mounted Closers: For use at Storage, Mechanical, Electrical, Sprinkler, Elevator, Unit Entries
a. LCN Closers; an Ingersoll-Rand Company); 1461 Series.
1) Sargent; 1431 Series. Provide parallel arm at Unit Entry doors.

B. Standards: Comply with the following:
1. Closers: BHMA A156.4.

C. Surface Closers: BHMA Grade 1.
1. Door closers shall have fully hydraulic, full rack and pinion action. Cylinder body shall be 1-1/2" in diameter, and double heat treated pinion shall be 11/16" in diameter.
2. Spring power shall be continuously adjustable over the full range of closer sizes 1 thru 6, and allow for reduced opening force for the physically handicapped. Hydraulic regulation shall be by tamper-proof, non-critical valves. Closers shall have separate adjustment for latch speed, general speed, and hydraulic back-check.
3. All closers shall have solid forged steel main arms (and forged forearms for parallel arm closers).
4. Closer arms shall have a powder coating finish.
5. Do not locate closers on the side of doors facing corridors, passageways or similar type areas. Where it is necessary, due to certain conditions and approval of the Architect, to have closers in corridors, provide such closers with parallel arms.
6. Door closers shall be adjusted by the installer in accordance with the manufacturer's templates and written instructions. Closers with parallel arms shall have back-check features adjusted prior to installation.
7. Closers shall conform to all applicable code and law requirements relative to setting closing speeds for closers and maximum pressure for operating interior and exterior doors.
8. Provide closers with full plastic covers, painted to finish indicated.

D. Swing: Allow door to swing to the maximum degree opening allowable for the swing condition. Where doors with closers do not have a bumper stop, provide closer with CUSH-N-STOP feature. Do not allow leading edge of door to swing into the path of an adjacent door opening.

E. Mounting Location and Clearance: To the maximum extent possible, mount closers on room side so they are not exposed in the corridors.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

F. Size of Units: Unless otherwise indicated, comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

2.12 POWERED DOOR OPERATORS

A. Electrically - Powered Door Operator
   1. Referenced Standard: Provide unit that conforms to AAMA/BHMA A156.19 low energy operation, and to ADA Architectural Guidelines for opening force and time to close standards.
   2. Products: Subject to compliance with requirements, furnish one of the following products:
      a. Horton 7000 LE
   3. General: Furnish complete system, including electro-mechanical swinging door operator and solid-state electronic control, aluminum header , connecting hardware, and power on/off switch.
   4. Operator: Opening by means of a fractional HP DC motor, through reduction gears, splined spindle, door arm and linkage assembly. If door encounters an obstacle, operator shall stop the door in the open position by electrically reducing the motor voltage and stalling. Spring closing, with closing speed controlled by the motor operating as a dynamic brake. Operator shall function as a manual door closer in the direction of swing, with or without electrical power.
      a. Operator shall be removable from the header as a unit, for servicing and replacement.
      b. Door Speed and Timing:
         1. Door opening time: Adjustable but not less than 4 seconds.
         2. Door closing time: Adjustable but not less than 4.5 seconds.
         3. Hold Open: Adjustable from 6 to 60 seconds, to allow safe passage between series of doors at entrance and vestibule.
      c. Furnish unit without power assist ("Push-N-Go") feature, or with device that allows Owner to activate or disconnect the feature after the door has been installed.
      d. Provide interface module for card access lock release.
   5. Header: 0.125 minimum wall thickness extruded aluminum.
   6. Metal Finish: Finish covers, mounting plates, and arm system with manufacturer's standard powder-coat finish and clear anodized finish.
   7. Push-Plate Control: Nominal 4 inch square or 4-1/2 inch diameter round push-plate control; stainless steel with No. 4 satin finish; with international accessibility symbol engraved and painted blue
      a. Furnish wall-mounted type, as appropriate to mounting conditions.

2.13 PROTECTIVE TRIM UNITS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Metal Protective Trim Units:
      a. Burns Manufacturing Incorporated.
      b. Don-Jo Mfg., Inc..
      c. Rockwood Manufacturing Company.

B. Standard: Comply with BHMA A156.6.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

C. Materials: Fabricate protection plates from the following:
   1. 0.050 inch thick; beveled top and 2 sides, US15 finish.

D. Fasteners: Provide manufacturer's oval head exposed fasteners for door trim units consisting of either machine or self-tapping screws, for installation in counter sunk holes.

E. Furnish protection plates sized 2 inches less than door width on push side by the following height:
   1. Armor Plates: 34 inches.
   2. Kick Plates: 8 inches

2.14 STOPS AND HOLDERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Glynn-Johnson; an Ingersoll-Rand Company.
   2. Hager Companies.
   3. Ives: H. B. Ives.
   4. Rixson-Firemark, Inc.; Div. of Yale Security Inc. .
   5. Rockwood Manufacturing Company.

B. Standards: Comply with the following:
   1. Stops and Bumpers: BHMA A156.16.
   2. Mechanical Door Holders: BHMA A156.16.
   3. Electromagnetic Door Holders: BHMA A156.15.
   4. Door Silencers: BHMA A156.16.

C. Stops and Bumpers: BHMA Grade 1.
   1. Wall Stops: Convex with concealed mounting.
   2. Floor Stops: Dome stop, base thickness to accommodate flooring thickness.
   3. Baseboard Door Stops: Taymor 4675 spring stop with fixed screw, white tip.

D. Wall Stops: For doors, unless floor or other type stops are scheduled or indicated. Do not mount floor stops where they will impede traffic.
   1. Where floor or wall stops are not appropriate, provide heavy duty overhead holders.
      a. Glynn-Johnson GJ90.
      b. Sargent 590.

E. Silencers for Metal Door Frames: BHMA Grade 1; neoprene or rubber, minimum diameter 1/2 inch; fabricated for drilled-in application to frame.

F. Overhead Stops
   1. Closet Doors: Glyn Johnson 450

2.15 SLIDING POCKET DOOR HARDWARE

A. Pocket Door Sliding Hardware: . No substitution of hardware capacity. Sizing based upon ease of operation, not door weight.
   1. Resident Unit Sliding Doors: Johnson Hardware pocket door kit;. 2511 for 2x4 stud walls, 1560 for 2x6 stud walls.
   2. Locate stops for proper clearance of door pulls.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

B. Pulls: Rockwood RM7902 GeoMetek, 3/4-inch by 3/4-inch diameter by 6 inch CTC, 2-1/4 inch projection, BB mount. US32D satin stainless steel.

C. Flush Pulls: Deltana FP223U15 oblong flush pocket door pull, 3-1/2 inches long by 1-1/4 inches wide by 5/16 inch deep, satin nickel finish.

D. Edge Pull: Deltana EP475U15, 4 inches long by 3/4 inches wide, satin nickel finish.

2.16 MISCELLANEOUS ACCESSORIES

A. Magnetic Catch: Ives 326, 92 Natural Aluminum finish.

2.17 DOOR GASKETING

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Door Gasketing and Door Bottoms:
   a. National Guard Products, Inc..
   b. Pemko Manufacturing Co., Inc.
   c. Reese Enterprises, Inc.
   d. Zero International, Inc.

B. General: Provide continuous weather-strip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated or scheduled. Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.
1. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
2. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
3. Door Bottoms: Flexible multi-fin, apply to bottom of door, forming seal with threshold when door is closed.

C. Weather-Strip Gasketing Models: Listed manufacturers with comparable models to the following:

Product	Pemko	Reese	NGP	
Brush Seal	45062AP	970	A626A	
Door Sweep	345AV	353	101AV	(Sweeps provided in addition to door bottoms)
Set Astragals	316 CS x 316 CS			
Door Bottom	234PK			

Smoke Seals

Head and Jambs: Kerf gasketing specified in Division 08 Section “Hollow Metal Doors and Frames.”

Astragals Set: Surface applied with concealed fasteners, silicone bulb with aluminum retainer, equal to Pemko 29310CPK.

D. Fire-Labeled and Smoke Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL 10B or NFPA 252.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1. Head and Jambs: Kerf gasketing specified in Division 08 Section “Hollow Metal Doors and Frames.”

2.18 THRESHOLDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. National Guard Products, Inc.
   2. Pemko Manufacturing Co., Inc.
   3. Reese Enterprises, Inc.
   4. Zero International, Inc.

B. Standard: Comply with BHMA A156.21.

C. General: Extruded aluminum, depth as required for sill condition. Where thresholds extend out beyond face of frame, provide returned closed ends by miter cutting on a 45 degree angle and return to face of frame.

D. Height: 1/2 inch ADA compliant.
   1. At exterior mechanical room doors, provide threshold with 3/8 inch high bumper stop.

2.19 FABRICATION

A. Base Metals: Produce door hardware units of base metal, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18 for finishes. Do not furnish manufacturer's standard materials or forming methods if different from specified standard.

B. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to commercially recognized industry standards for application intended. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.
   1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
   2. Steel Machine or Wood Screws: For the following fire-rated applications:
      a. Mortise hinges to doors.
      b. Strike plates to frames.
      c. Closers to doors and frames.
   3. Spacers or Sex Bolts: For through bolting of hollow metal doors.
   4. Fasteners for Wood Doors: Comply with requirements of DHI WDHS.2, "Recommended Fasteners for Wood Doors."
   5. Fasteners for exterior doors shall be stainless steel.

2.20 FINISHES

A. Standard: Comply with BHMA A156.18.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. BHMA Designations: Comply with base material and finish requirements indicated by the following:
   1. BHMA 619 (US15): Satin nickel plated clear coated, over brass or bronze base metal.
   2. BHMA 646 (US15): Satin nickel plated clear coated, over steel base metal.

E. With the exceptions of exit devices, door closers, thresholds and weatherstripping, all hardware items shall be furnished in nickel finish US15.
   1. Exceptions are as follows:

Exit Devices:	US15 or 32D
Door Closers:	Sprayed Aluminum Provide sprayed black for closers on unit entry doors.
Thresholds:	Aluminum
Weatherstripping:	Clear Anodized Aluminum

PART 3 - EXECUTION

3.1 EXAMINATION

A. Contractor shall examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance. If errors in dimensions or preparation are encountered, they are to be corrected by the responsible parties prior to the installation of hardware.

B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Steel Doors and Frames: Comply with DHI A115 series.
   1. Surface-Applied Door Hardware: Drill and tap doors and frames according to SDI 107.

B. Wood Doors: Comply with DHI A115-W series.

3.3 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 09 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

C. Sliding pocket door frames shall be set plumb and level. Mount pull 1-1/2 inches from leading edge of door. Stop door to provide 1-1/2 inches of clearance from edge of pull to face of trim with door in fully open position.

D. Exit devices shall be carefully installed so as to permit friction free operation of touch bar and lever. Latching mechanism shall also operate freely without friction or binding.

E. Key Control System: Place keys on markers and hooks in key control system cabinet, as determined by final keying schedule.

F. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, within lockable rooms. Verify location with Architect.
1. At doors with local power supplies, provide the low voltage wire and connections from the power supply to the electrified door hardware.
2. Cables from local power supply to access control security equipment provided by the Owner’s security controls vendor.

G. Door closers shall be installed in accordance with the manufacturer's instructions. Each door closer shall be carefully installed, on each door, at the degree of opening dictated by the frame condition relative to adjacent construction and clearances to permit full swing of the door to the door stops. Arm position shall be as shown on the instruction sheets.
1. The adjustments for all door closers shall be the installer’s responsibility and these adjustments shall be made at the time of installation of the door closer. The closing speed and the latching speed valves shall be adjusted individually to provide a smooth, continuous closing action without slamming. The delayed action feature or back check valve shall also be adjusted so as to permit the correct delayed action cycle or hydraulic back check cushioning of the door in the opening cycle. All valves shall be properly adjusted at the time of installation. Each door closer has adjustable spring power capable of being adjusted, in the field, from size 1 thru 6. It shall be the installer’s responsibility to adjust the spring power for each door closer in exact accordance with the spring power adjustment chart illustrated in the door closer installation sheet packed with each door closer.
2. Where wood trim occurs, screw fasten closer arm attachment through trim, into hollow metal frame. Predrill wood to prevent splitting.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

H. Coordinate installation of hinges in wood doors to prevent requiring the removal and reinstallation of screws into the edges. Do not remove screws after they have been installed on fire rated doors. Provide proper torque on screws without over tightening and stripping.

I. Thresholds: Set thresholds for exterior doors in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."

J. Prior to Substantial Completion, the installer, accompanied by representative of the supplier of latchsets and locksets, closers, door control devices, and other major hardware, shall perform the following work:
   1. Examine and re-adjust each item of door hardware as necessary to restore function of doors and hardware to comply with specified requirements. Review the location of door closers and verify door closers are properly installed for the degree of swing required to permit maximum opening range of the door without binding or stress that could damage doors and frames. Verify arm position is at proper location.
   2. Consult with and instruct Owner’s personnel in recommended additions to the maintenance procedures.
   3. Replace hardware items that have deteriorated or failed due to faulty design, materials, or installation of hardware units.
   4. Submit report of onsite inspection. Include door location where hardware does not operate properly, and corrective measures taken.

3.4 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
   1. Door Closers: Adjust sweep period so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the leading edge of the door.

B. Six-Month Adjustment: Approximately six months after date of Substantial Completion, Installer shall perform the following:
   1. Examine and readjust each item of door hardware as necessary to ensure function of doors, door hardware, and electrified door hardware.
   2. Consult with and instruct Owner's personnel on recommended maintenance procedures.
   3. Replace door hardware items that have deteriorated or failed due to faulty design, materials, or installation of door hardware units.

3.5 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

3.6 DEMONSTRATION

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes.

3.7 DOOR HARDWARE SCHEDULE

A. Each Hardware Set listed below represents the complete hardware requirements for one opening (single door or pair of doors). Furnish the quantities required for each set for the work.

HW

Exterior Parking Elevator Lobby Entry (Single HM x HM - Rated)
Door:
Each Leaf Shall Have: Hinges, Rim Exit Device, Pull, Electric Strike, Power Supply, Automatic Door Operator, Push Pad Actuator, Kick Plate, Cylinders

Note: Kerfed frames with smoke seals specified in 081113.
Note: FOB Reader, Controller Access System and FOBs by access control vendor.

Operation Narrative: Door always locked. Door operated as manual door by pressing on exit device, with automatic door operator acting as manual closer. Pressing elevator lobby interior push pad actuator releases electric strike and automatic door operator opens door. Exterior card reader releases electric strike and automatic door operator opens door. Electric strikes fail secure to maintain latching of fire rated door and maintain locking of door.

HW

Exterior Stair Entry (Single HM x HM - Rated)
Door: 1.8.01, 1.8.02
Each Leaf Shall Have: Hinges, Rim Exit Device, Pull, Electric Strike, Power Supply, Closer, Threshold, Sweep, Door Bottom (in addition to sweep), Cylinders

Note: Kerfed frames with smoke seals specified in 081113.
Note: FOB Reader, Controller Access System and FOBs by access control vendor.

Operation Narrative: Door always locked. Door operated from stair as manual door by pressing on exit device. Exterior card reader releases electric strike. Electric strikes fail secure to maintain latching of fire rated door and maintain locking of door.

HW

Electrical Room (Single HM x HM - Rated)
Doors:
Each Leaf Shall Have: Hinges, Exit Device w/Trim (Storeroom Function), Closer, Door Wall Stop

Note: Kerfed frames with smoke seals specified in 081113.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

HW

Resident Storage (Single HM x HM - Rated)
Door:
Each Leaf Shall Have: Hinges, Lockset (5400 Series Store Room Function), Electric Strike, Power Supply, Closer

Note: Kerfed frames with smoke seals specified in 081113.
Note: FOB Reader, Controller Access System and FOBs by access control vendor.

Operation Narrative: Door always locked. Door operated from Storage side as manual door by lever lockset. Exterior card reader releases electric strike. Electric strikes fail secure to maintain latching of fire rated door and maintain locking of door.

HW 12

Exterior Mechanical (Single HM x HM - Rated)
Door:
Each Leaf Shall Have: Hinges, Lockset (5400 Series Storeroom Function), Closer, Threshold, Sweep, Door Bottom (in addition to sweep)

Note: Kerfed frames with weather seals specified in 081113.

HW

Interior Unit Entry (Single WD x HM - Rated)
Door:
Each Opening Shall Have: 2 Spring Hinges, BB Hinge, Lockset (Interconnected Entry Function)

Note: Kerfed frames with perimeter smoke seals specified in 081113.

HW

Hall Stairs (Single HM x HM - Rated)
Door:
Each Opening Shall Have: Hinges, Latchset (5400 Series Passage Function), Closer, Door Wall Stop

Note: Kerfed frames with perimeter smoke seals specified in 081113.

HW

Interior Sprinkler Room (Single WD x HM)
Door:
Each Opening Shall Have: Hinges, Lockset (5400 Series Storeroom Function), Silencers

Note: Kerfed frames with perimeter smoke seals specified in 081113.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

HW

Elevator Control Room (Single WD x HM)
Door:
Each Opening Shall Have: Hinges, Lockset (5400 Series Storeroom Function), Closer

Note: Kerfed frames with perimeter smoke seals specified in 081113.

HW

Exterior Clad Wood Doors (Swing and Sliding Residential)
Doors:

Hardware provided with doors specified in Section 081420 - Exterior Clad Wood Doors.

RESIDENT UNITS - INTERIOR

RU HW 1

Bath, Bedroom (Single Swing)
Doors:
Each Leaf Shall Have: Lockset (Privacy Function), Baseboard Door Stop (Where leaf swings against wall)

Note: Hinges provided with prehung door specified in Section 081416 – Wood Doors

RU HW 2

Closets / Entry, Bedroom, Pantry, Kitchen, Linen - WD/Laundry - Interior Mechanical Room (Swing)
Doors:
Each Leaf Shall Have: Latchset (Passage Function), Baseboard Door Stop (Where leaf swings against wall)

Note: Hinges provided with prehung door specified in Section 081416 – Wood Doors

RU HW 3

Closets / Entry, Kitchen/Pantry, WD/Laundry, Bedroom (Pair Swing)
Doors:
Each Leaf Shall Have: Magnetic Catches, Dummy Lever Pulls, Baseboard Door Stop (Where leaf swings against wall)
Provide surface applied overhead stop on leaf of Kitchen/Pantry doors that swing against cabinets/refrigerator

Note: Hinges provided with prehung door specified in Section 081416 – Wood Doors

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

RU HW 4

Bathroom, Bedroom, Closet, Laundry (Single Sliding Pocket - Passage)
Doors:
Each Leaf Shall Have: Pocket Door and Sliding Hardware (Johnson 2511 - 2x4 / 1560 - 2x6), Flush Pulls, Edge Pull

RU HW 5

Bedroom Closet - Bathroom (Biparting Sliding Pocket - Passage)
Doors: C.2, C.3
Each Leaf Shall Have: Pocket Door and Sliding Hardware (Johnson 2511 - 2x4 / 1560 - 2x6), 6" Pulls (Both sides of both leafs)

Note: Install pocket door stops to stop leading edge of door 3-1/2 inches from pocket to permit installation of pulls with approximately 1-1/2 inches of clearance from edge of pull to edge of trim in the open and closed position.

END OF SECTION 087100

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

SECTION 088000 - GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
   1. Doors.
   2. Storefront framing.
   3. Glazed entrances.

B. Related Sections:
   1. Division 08 Section "Wood Doors" for factory glazing of wood doors with glazed openings.
   2. Division 08 Sections "Exterior Clad Wood Doors" for factory glazing of doors.
   3. Division 08 Sections "Clad Wood Windows" for factory glazing of windows.

C. Products furnished, but not installed, under this Section include the following:
   1. Deal tray installed in Division 06 Section "Architectural Woodwork."

1.3 DEFINITIONS

A. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

B. Interspace: Space between lites of an insulating-glass unit.

1.4 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
   1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

1.5 ACTION SUBMITTALS

A. Product Data: For each glass product and glazing material indicated.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

B. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.6 INFORMATIONAL SUBMITTALS

A. Product Certificates: For glass and glazing products, from manufacturer.

B. Warranties: Sample of special warranties.

1.7 QUALITY ASSURANCE

A. Source Limitations for Glass: Obtain coated float glass, fire-rated glazing, and insulating glass from single source from single manufacturer for each glass type.

B. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

C. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
   1. GANA Publications: GANA's "Laminated Glazing Reference Manual" and GANA's "Glazing Manual."
   2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

D. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

E. Fire-Protection-Rated Glazing Labeling: Permanently mark fire-protection-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, test standard, whether glazing is for use in fire doors or other openings, whether or not glazing passes hose-stream test, whether or not glazing has a temperature rise rating of 450 deg F, and the fire-resistance rating in minutes.

F. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
   1. Protect fire-resistive glazing from ultraviolet light.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or below 40 deg F.

1.10 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form in which coated-glass manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
   1. Warranty Period: 10 years from date of Substantial Completion.

B. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form in which insulating-glass manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
   1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GLASS PRODUCTS, GENERAL

A. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.
   1. Minimum Glass Thickness for Exterior Lites: Not less than 6.0 mm.

B. Strength: Where float glass is indicated, provide annealed float glass. Where fully tempered glass or safety glazing is indicated or required by code, provide Kind FT heat-treated float glass.

2.2 GLASS PRODUCTS

A. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.

B. Safety Glass (Fully Tempered): ASTM C 1048; Kind FT (fully tempered), Condition A (uncoated), Type I (transparent flat glass); Class 1(clear); Quality q3 (glazing select); conforming to ANZI A97.1.

C. Clear, Sputter-Coated Float Glass: ASTM C 1376, float glass with metallic-oxide or -nitride coating deposited by vacuum deposition process after manufacture and heat treatment (if any), and complying with other requirements specified.
   1. Basis-of-Design: Subject to compliance with requirements, provide LoE-180 Glass by Cardinal Glass Industries or a comparable product from one of the following manufacturers:
      a. Guardian Industries Corporation.
      b. Pilkington North America, Inc.
      c. PPG Industries, Inc.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

2.3 INSULATING GLASS

A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190, and complying with other requirements specified.
   1. Sealing System: Dual seal, with manufacturer's standard primary and secondary.
   2. Spacer: Manufacturer's standard warm edge spacer material and construction.
   3. Desiccant: Molecular sieve or silica gel, or blend of both.

B. Glass: Comply with applicable requirements in "Glass Products" Article as indicated by designations in "Insulating-Glass Types" Article.

C. Low-E, Clear, Insulated Glass Units:
   1. Overall Unit Thickness:
      a. For Exterior Locations Other Than Doors: Inner and outer panes of 6.0 mm glass; total unit thickness of 1 inch minimum.
      b. For Exterior Doors: Inner and outer panes of 3/16 clear glass; total unit thickness of 5/8 inch minimum.
   2. Outdoor Lite: Class 1 (clear) float glass, except as noted.
      a. Kind FT (fully tempered) where indicated or required by code.
   3. Interspace Content: Argon.
   4. Indoor Lite: Class 1 (clear) float glass, except as noted.
      a. Kind FT (fully tempered) where indicated or required by code.
   5. Low-E Coating: Sputtered on second surface.
   6. Visible Light Transmittance: 78 percent minimum.
   7. Winter Nighttime U-Factor: 0.25 maximum.
   8. Shading Coefficient: 0.27 maximum.
   9. Solar Heat Gain Coefficient: 0.68 maximum.
   10. Provide safety glazing labeling on fully tempered glass.

2.4 FIRE-PROTECTION-RATED GLAZING

A. Fire-Protection-Rated Glazing, General: Listed and labeled by Underwriters Laboratories (UL) a testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 252 for door assemblies.

B. Laminated Ceramic Glazing: Laminated glass made from 2 plies of clear, ceramic flat glass; 5/16-inch total nominal thickness; complying with testing requirements in 16 CFR 1201 for Category II materials.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Nippon Electric Glass Co., Ltd. (distributed by Technical Glass Products); FireLite Plus.
      b. Schott North America, Inc.; Laminated Pyran Crystal.
      c. Vetrotech Saint-Gobain; SGG Keralite FR-L.
   2. Fire-Protection Rating: As indicated for the assembly in which glazing material is installed, and permanently labeled by a testing and inspecting agency.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

2.5 GLAZING GASKETS

A. Dense Compression Gaskets: Molded or extruded gaskets of profile and hardness required to maintain watertight seal, made from one of the following:
   1. EPDM complying with ASTM C 864.
   2. Silicone complying with ASTM C 1115.
   3. Thermoplastic polyolefin rubber complying with ASTM C 1115.

2.6 GLAZING SEALANTS

A. General:
   1. Compatibility: Provide glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
   2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
   3. Sealants used inside the weatherproofing system shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
   4. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 50, Use NT.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Dow Corning Corporation; 791 or 795.
      b. GE Advanced Materials - Silicones; SilPruf NB SCS9000 or UltraPruf II SCS2900.
      c. Pecora Corporation; 895.
      d. Tremco Incorporated; Spectrem 2 or Spectrem 3.

C. Glazing Sealants for Fire-Rated Glazing Products: Products that are approved by testing agencies that listed and labeled fire-resistant glazing products with which they are used for applications and fire-protection ratings indicated.

2.7 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
   1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
   2. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
   1. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.8 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

G. Perimeter Insulation for Fire-Resistive Glazing: Product that is approved by testing agency that listed and labeled fire-resistant glazing product with which it is used for application and fire-protection rating indicated.

2.9 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
   1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
   2. Presence and functioning of weep systems.
   3. Minimum required face and edge clearances.
   4. Effective sealing between joints of glass-framing members.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that will leave visible marks in the completed work.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance. Protect glass edges as follows:
   1. Use a rolling block in rotating glass units to prevent damage to glass corners.
   2. Do not impact glass with metal framing.
   3. Use suction cups to shift glass units within openings. Do not raise or drift glass with a pry bar.
   4. Rotate glass lites with flares or bevels on bottom horizontal edges so edges are located at top of opening, unless otherwise indicated by manufacturer's label.

D. Apply primers to joint surfaces where required for adhesion of sealants.

E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where length plus width is larger than 50 inches.
   1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
   2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

J. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until right before each glazing unit is installed.

F. Apply heel bead of elastomeric sealant.

G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 CLEANING AND PROTECTION

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

END OF SECTION 088000

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

SECTION 092500 - EXTERIOR GYPSUM SHEATHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes exterior gypsum wall sheathing.

B. Related Requirements:
1. Division 06 Section "Rough Carpentry" for plywood wall sheathing, roof sheathing and plywood backing panels.
2. Division 07 Section "Weather Barriers" for weather barrier applied over wall sheathing.
3. Division 09 Section "Gypsum Board Assemblies" for interior gypsum panels.

1.3 ACTION SUBMITTALS

A. Product Data: For each product indicated. Indicate component materials and dimensions and include construction and application details.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For assemblies with fire-resistance ratings, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory."

2.2 WALL SHEATHING

A. Glass-Mat Gypsum Wall Sheathing (Exterior G.W.B.): ASTM C 1177/1177M; moisture- and mold-resistant core and facers.
1. Products: Subject to compliance with requirements, provide one of the following:
a. CertainTeed Corporation; GlasRoc.
b. G-P Gypsum Corporation; Dens-Glass Gold.
c. National Gypsum Company; Gold Bond Extended Exposure Sheathing e(2)XP.

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

2. Type and Thickness: Type X, 5/8 inch thick.
3. Size: 48 inches by maximum available lengths for vertical installation.
4. Mold-Resistance: ASTM D3273, rating of 10.

2.3 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
   1. For wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates and abutting structural framing, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated, complying with the following:
   1. NES NER-272 for power-driven fasteners.
   2. Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code."

D. Coordinate wall sheathing installation with flashing installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

3.3 GYPSUM SHEATHING INSTALLATION

A. Comply with GA-253 and with manufacturer's written instructions.
   1. Fasten gypsum sheathing to wood framing with screws.
   2. Install boards with a 1/4-inch gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.

B. Cut boards at penetrations, edges, and other obstructions of the work; fit tightly against abutting construction, except provide a 3/8-inch setback where construction abuts structural elements.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

C. Coordinate sheathing installation with flashing and joint sealant installation so these materials are installed in the sequence and manner that prevent exterior moisture from passing through completed exterior wall assembly.

D. Apply fasteners so heads bear tight against but flush with surface of sheathing, but do not cut into facing.

E. Horizontal Installation: Abut ends of boards over centers of studs, and stagger end joints of adjacent boards not less than one stud spacing. Attach boards at perimeter and within field of board to each steel stud.
   1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of boards.

END OF SECTION 092500

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

SECTION 092950 - GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
1. Interior gypsum wallboard.
2. Exterior gypsum board panels for covered parking ceilings and soffits.
3. Tile backing panels.
4. Miscellaneous steel framing.
5. Exterior suspension systems.
6. Gypsum board shaft wall assemblies.
7. Sound attenuation batts in wood-framed assemblies and shaft wall.
8. Acoustical sealants.
9. Firestopping at wall and partition perimeters of fire-rated construction.

B. Related Sections include the following:
1. Division 06 Section "Rough Carpentry" for wood framing and concealed wood blocking in gypsum board assembly walls.
2. Division 07 Section "Building Insulation" for thermal insulation and vapor retarders installed in gypsum board assemblies.
3. Division 07 Section "Spray-In-Place Rigid Urethane Foam Insulation" for spray foam thermal insulation.
4. Division 07 Section "Through-Penetration Firestopping Systems" for joint systems not part of this Section.
5. Division 07 Section "Fire-Resistive Joint Systems" for fire-resistive joints not covered by work of this Section.
6. Division 07 Section "Joint Sealants" for sealants not covered by work of this Section.
7. Division 09 Section "Exterior Gypsum Sheathing" for exterior sheathing applied to exterior walls.
8. Division 09 Section "Painting" for coordination/inspection requirements with painting contractor and primers applied to gypsum board surfaces.

1.3 DEFINITIONS

A. Gypsum Board Terminology: Refer to ASTM C 11 and GA-505 for definitions of terms for gypsum board assemblies not defined in this Section or in other referenced standards.

1.4 SUBMITTALS

A. General: Submit in accordance with Division 01 Section "Submittal Procedures."

B. Product Data: For each type of product indicated.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

C. Shop Drawings: Show locations, fabrication, and installation of control joints including plans, elevations, sections, details of components, and attachments to other units of Work.
   1. Submit marked up floor plans with location of all control joints in gypsum board walls and ceilings.
   2. Firestopping: For each joint condition where fire-rated walls and partitions interface other walls, floors, structural members or other building structure, provide UL firestop system description and drawing. Show each kind of construction condition and relationships to adjoining construction. Indicate which firestop materials will be used where and thickness for different hourly ratings. Include UL firestop design designation that evidences compliance with requirements for each condition.

1.5 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: For gypsum board assemblies with fire-resistance ratings, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.
   1. Fire-Resistance-Rated Assemblies: Indicated by design designations from UL's "Fire Resistance Directory," GA-600, "Fire Resistance Design Manual," or in the listing of another testing and inspecting agency acceptable to authorities having jurisdiction.

B. Sound Transmission Characteristics (STC): For gypsum board assemblies with STC ratings, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by a qualified independent testing agency.
   1. STC-Rated Assemblies: Indicated by design designations from GA-600, "Fire Resistance Design Manual" or another testing and inspecting agency acceptable to authorities having jurisdiction.

C. Source Limitations for Panel Products: Obtain each type of gypsum board and other panel products from a single source from a single manufacturer.

D. Source Limitations for Finishing Materials: Obtain finishing materials from either manufacturer supplying gypsum board and other panel products or from a manufacturer acceptable to gypsum board manufacturer.

E. Gypsum Board Finish Mockups: Before finishing gypsum board assemblies, install mockups using room designated by Architect to demonstrate aesthetic effects and qualities of materials and execution.
   1. Install mockups for surfaces indicated to receive nontextured paint finishes.
   2. Simulate finished lighting conditions for review of mockups.
   3. Mockup will be painted under Division 09 Section "Painting" to provide finished condition for viewing.
   4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.

B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

C. Stack gypsum panels flat on leveled supports off floor or slab to prevent sagging.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Establish and maintain environmental conditions for applying and finishing gypsum board to comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install interior products until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.
   1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
   2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

D. Room Temperatures: For nonadhesive attachment of gypsum board to framing, maintain not less than 40 deg F. Do not exceed 95 deg F when using temporary heat sources.

E. Ventilation: Ventilate building spaces as required to dry joint treatment materials. Avoid drafts during hot, dry weather to prevent finishing materials from drying too rapidly.

F. Exterior Gypsum Board Work: Maintain not less than 50 degrees for taping and finishing.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:
   1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.
   2. Products: Subject to compliance with requirements, provide one of the products specified.

2.2 STEEL SUSPENDED CEILING AND SOFFIT FRAMING

A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, not less than 0.0625-inch-diameter (8-gage) wire, or double strand of not less than 0.099
   1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching hanger wires and capable of sustaining, without failure, a load equal to 5 times that imposed by construction.

B. Hangers: As follows:
   1. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.162-inch diameter.

C. Carrying Channels: Cold-rolled, commercial-steel sheet with a base metal thickness of 0.0538 inch, a minimum 1/2-inch- wide flange, with ASTM A 653/A 653M, G60, hot-dip galvanized zinc coating.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

D. Furring Channels (Furring Members): Commercial-steel sheet with ASTM A 653/A 653M, G60, hot-dip galvanized zinc coating.
   1. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch deep.
      a. Minimum Base Metal Thickness: 0.0312 inch (22 gage).

E. Compression Posts (Uplift Posts): Commercial-steel sheet with ASTM A 653/A 653M, G60, hot-dip galvanized zinc coating.
   1. Rigid post of required size and length to resist wind uplift at exterior suspended ceilings.

F. Grid Suspension System for Ceilings: ASTM C 645, direct-hung system composed of G90 hot dip galvanized main beams and cross-furring members that interlock, heavy-duty.
   1. Products:
      a. Armstrong World Industries, Inc.; Drywall Grid Systems.
      b. Chicago Metallic Corporation; 640-C Drywall Furring System.
      c. USG Interiors, Inc.; Drywall Suspension System.
      d. Provide comparable system where fire-rated ceilings are indicated.

2.3 MISCELLANEOUS STEEL FRAMING

A. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
   1. Minimum Base Metal Thickness: 0.0179 inch (26 gage).
      a. Covered Parking Ceiling: Furring channels supporting double layer gyp and suspended gypsum ceiling shall be of gage required to support weight of assembly and provide for adequate attachment of suspended ceiling anchors, but not less than 20 gage.
   2. Depth: 7/8 inch.

B. Resilient Furring Channels: 1/2-inch- deep, steel sheet members designed to reduce sound transmission.
   1. Configuration: Asymmetrical.

C. Sound Isolation Clips for Rigid Furring Channels: Sound isolation clips for attaching furring channels to framing.
   1. Product: AcoustiGuard - WILREP LTD.; GenieClip.

D. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel furring members to substrates involved; complying with the recommendations of gypsum board manufacturers for applications indicated.

2.4 PANELS, GENERAL

A. Manufacturers: Unless indicated otherwise, provide products by one of the following:
   1. G-P Gypsum Corporation.
   2. National Gypsum Company.
   3. United States Gypsum Company.

B. Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

2.5 INTERIOR GYPSUM WALLBOARD

A. General: Complying with ASTM C 36/C 36M or ASTM C 1396/C 1396M, as applicable to type of gypsum board indicated and whichever is more stringent.

B. Type X, GWB:
1. Thickness: 5/8 inch.
2. Long Edges: Tapered.
3. Face Sheets: 100 percent post-consumer recycled content.
4. Location: All locations, except as otherwise noted.

C. Type C: ASTM C 1396/C 1396M. Manufactured to have increased fire-resistive capability.
1. Thickness: 5/8 inch to comply with indicated UL assembly indicated on Drawings.
2. Long Edges: Tapered.
3. Location: Where required for specific fire-resistance-rated assembly indicated.

D. Moisture- and Mold-Resistant Type: ASTM C 1396/C 1396M with moisture- and mold-resistant core and paper surfaces.
1. Core: 5/8 inch, Type X, except as indicated.
   a. Provide 5/8 inch, Type C at the following locations:
      1) Bathroom ceilings.
      2) Parking garage ceilings.
2. Long Edges: Tapered.
3. Mold-Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
4. Face Sheets: 100 percent post-consumer recycled content.
5. Location: Provide at the following locations:
   a. Interior face of all exterior walls.
   b. Walls and ceilings of all bathrooms.
   c. Ceiling of parking garage.
   d. Where indicated.
   e. Note: Do not use moisture- and mold-resistant board behind tile; use tile backer board behind tile on walls.
6. Products:
   a. National Gypsum Co.; Gold Bond Brand XP Fire-Shield Gypsum Board.
      1) Provide Gold Bond Brand XP Fire-Shield C Gypsum Board for indicated ceilings.

   b. United States Gypsum Co.; Mold Tough Firecode Panels.
      1) Provide Mold Tough Firecode C Panels for indicated ceilings.

2.6 EXTERIOR GYPSUM PANELS FOR SOFFITS AND COVERED PARKING CEILINGS

A. Exterior Gypsum Soffit Board: ASTM C 931/C 931M and ASTM C 1396/C 1396M, weather-, sag- and warp-resistant, with manufacturer's standard edges.
1. Core: 5/8 inch, Type X.
2. Products:
   a. G-P Gypsum Corp.; ToughRock Soffit Board.
   b. National Gypsum Co.; Gold Bond Exterior Soffit Board.
   c. United States Gypsum Co.; Sheetrock Exterior Gypsum Ceiling Board.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

2.7 TILE BACKING PANELS

A. Glass-Mat, Water-Resistant Backing Board: Complying with ASTM C 1178/C 1178M.
1. Core: 5/8 inch, Type X.
2. Mold-Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
3. Products:
a. DensShield Tile Guard; G-P Gypsum Corporation.
b. National Gypsum Company; Gold Bond e^{2}XP Tile Backer Panel.
c. CertainTeed Corporation; GlasRoc Tile Backer Panel.
4. Locations: Behind wall tile.

2.8 GYPSUM BOARD SHAFT-WALL ASSEMBLIES

A. General: Provide assemblies constructed of proprietary gypsum liner panels inserted between steel tracks at each end of studs; with specially shaped steel studs engaged in tracks and fitted between gypsum liner panels; and with gypsum board on finished side or sides applied to studs in the number of layers, thicknesses and arrangement indicated.

B. Manufacturers:
1. G-P Gypsum Corporation.
2. National Gypsum Company.
3. United States Gypsum Company.

C. Fire-Resistance Rating: 2 hours.

D. STC Rating: As indicated.

E. Framing Members: Comply with ASTM C 754 for conditions indicated; steel sheet components complying with ASTM C 645; manufacturer's standard stud profile for repetitive members, corner and end members, and for fire-resistance-rated assembly indicated.
1. Protective Coating: ASTM A 653/A 653M, G40, hot-dip galvanized, unless otherwise indicated. Substitute coatings not allowed.
2. Depth: As indicated.
3. Minimum Base Metal Thickness: Manufacturer's standard thicknesses that comply with structural performance requirements for stud depth indicated, but not less than 0.0359 inch (20 gage).
4. Runner Track: Manufacturer's standard J-profile track with long-leg length as standard with manufacturer, but at least 2 inches, in depth and gage matching studs.
5. Track Fasteners: Power-driven fasteners of size and material required to withstand loading conditions imposed on shaft-wall assemblies without exceeding allowable design stress of track, fasteners, or structural substrates in which anchors are embedded.
a. Powder-Actuated Fasteners: Provide powder-actuated fasteners with capability to sustain, without failure, a load equal to 10 times that imposed by shaft-wall assemblies, as determined by testing conducted by a qualified independent testing agency according to ASTM E 1190.

F. Gypsum Liner Panels: Comply with ASTM C 442/C 442M.
1. Type X: Manufacturer's proprietary liner panels with moisture-resistant paper faces.
a. Core: 1 inch thick.
b. Long Edges: Double bevel.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

G. Room-Side, Gypsum Panels for Shaft Wall Partitions: As indicated; see panel products in Interior Gypsum Wallboard Article above.

H. Cavity Insulation for Shaft Wall Partitions: Provide sound-attenuation batts in cavity formed by studs between shaft-wall liner panels and room-side finish.

I. Finishes:
1. Room-Side: As indicated.
2. Shaft Side: Provide only where finish is indicated on shaft side as well as room side, otherwise leave liner panel exposed.

2.9 TRIM ACCESSORIES

A. Interior Metal Trim: ASTM C 1047, galvanized steel.
1. Shapes:
a. Cornerbead: 1-1/4 inch x 1-1/4 inch external corner with 1/8-inch nose bead. Use at outside corners, unless otherwise indicated.
b. LC-Bead (Casing): J-shaped casing with 1/16-inch nose bead ground, not less than 30 gage; exposed long flange receives joint compound; use at exposed panel edges.
c. Expansion (Control) Joint: One-piece control joint formed with V-shaped slot and removable strip covering slot opening.

B. Exterior Trim: ASTM C 1047.
1. Material: Hot-dip galvanized steel sheet or rolled zinc.
2. Shapes:
a. Cornerbead: Use at outside corners.
b. LC-Bead (Casing): J-shaped; exposed long flange receives joint compound; use at exposed panel edges.
c. Expansion (Control) Joint: One-piece, rolled zinc with V-shaped slot and removable strip covering slot opening. Use where indicated.

2.10 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475 and the recommendations of both the manufacturers of sheet products and of joint treatment materials for each application indicated.

B. Joint Tape:
1. Interior Gypsum Wallboard: Paper reinforcing tape.
2. Exterior Gypsum Wallboard Fiberglass Tape (Exterior soffits and ceilings Only): USG Sheetrock Brand with cross-laminated construction, NO substitution, with setting type compound only.
3. Glass-Mat, Water-Resistant Tile Backing Panels: As recommended by panel manufacturer.

C. Setting-Type Joint Compound: Factory-packaged, job-mixed, chemical-hardening powder products formulated for uses indicated.
1. Where setting-type joint compounds are indicated as a taping compound only or for taping and filling only, use formulation that is compatible with other joint compounds applied over it.
2. For topping compound, use sandable formulation.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

D. Drying-Type Joint Compound: Factory-packaged vinyl-based products complying with the following requirements for formulation and intended use.
   1. Ready-Mixed Formulation: Factory-mixed product; all-purpose compound formulated for both taping and topping compounds.

E. Type of Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
   1. Prefilling: At open joints, beveled panel edges, and damaged surface areas, use setting-type taping compound.
   2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound or drying-type, all-purpose compound.
   3. Fill Coat: For second coat, use setting-type, sandable topping compound or drying-type, all-purpose compound.
   4. Finish Coat: For third coat, use setting-type, sandable topping compound or drying-type, all-purpose compound.

F. Joint Compound for Exterior Applications:
   1. Exterior Gypsum Soffit Board: Use setting-type taping and setting-type, sandable topping compounds.

G. Joint Compound for Tile Backing Panels:
   1. Glass-Mat, Water-Resistant Backing Panel: As recommended by manufacturer.
      a. Use setting type compound only for panels receiving tile finishes.

2.11 ACOUSTICAL SEALANT

A. Products:
   1. Acoustical Sealant for Exposed and Concealed Joints:
      a. Pecora Corp.; AC-20 FTR Acoustical and Insulation Sealant.
      b. United States Gypsum Co.; SHEETROCK Acoustical Sealant.
   2. Acoustical Sealant for Concealed Joints:
      a. Ohio Sealants, Inc.; Pro-Series SC-175 Acoustical Sound Sealant.
      b. Pecora Corp.; AIS-919.
      c. Tremco, Inc.; Tremco Acoustical Sealant.

B. Acoustical Sealant for Exposed and Concealed Joints: Nonsag, paintable, nonstaining, latex sealant complying with ASTM C 834 that effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

C. Acoustical Sealant for Concealed Joints: Nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant recommended for sealing interior concealed joints to reduce airborne sound transmission.

2.12 SEALANTS FOR FIRE-RESISTANCE-RATED CONSTRUCTION

A. General: Provide fire-resistive joint systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which fire-resistive joint systems are installed. Fire-resistive joint systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases.

62 India Str
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Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

B. Joints in or between Fire-Resistance-Rated Construction: Materials shall comply with Division 07 Section "Fire-Resistive Joint Systems" and submitted UL assemblies.
   1. Provide firestopping where fire rated gypsum board assemblies butt masonry, joists, beams, and structural members as part of the gypsum board assembly work.
   2. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of construction they will join.
   3. Joints shall be sealed with fire-resistance-rated sealants; use of joint compound for sealing of joints is not permitted.

C. Exposed Fire-Resistive Joint Sealants: Exposed sealants shall be paintable.

2.13 SOUND ISOLATION MATERIALS

A. Sound Attenuation Batts: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass that is fire resistance in accordance with ASTM E 136 and sound control in accordance with ASTM E 423; designed to reduce airborne sound transmission; with maximum flame-spread and smoke-developed indices of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics. Thermal fiberglass insulation not allowed.
   1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of UL assemblies indicated.
   2. Sound Attenuation Batts in Wall Assemblies: Provide in thickness for full depth of cavity. Where cavity requires insulation that is thicker than standard size, install next larger size and compress into cavity.
      a. STC Rating for Interior Walls: As indicated.
   3. Products:
      a. Johns Manville; Fiberglass Sound Control Batts.
      b. Knauf Insulation; Quiet Therm Acoustical/Thermal Batt Insulation.
      c. Owens Corning; Sound Attenuation Batt Insulation.

B. Dense pack cellulose insulation used for sound attenuation specified in Division 07 Section "Building Insulation."

2.14 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
   1. Fastening gypsum board to steel members: Type S bugle head.
   2. Provide corrosion resistant stainless steel or coated screw fasteners for exterior ceilings and soffits that resist rusting, designed for exterior application.

C. Thermal Insulation: As specified in Division 07 Section "Building Insulation" and "Spray-In-Place Rigid Urethane Foam Insulation."

D. Vapor Retarder: As specified in Division 07 Section "Building Insulation."

E. Insulation Support Anchors: Continuous, galvanized metal support strip, 25 gage, with pre-punched tabs at 8 inches on center.
   1. Product: Insul-hold; Insul-Hold Co., Inc.; phone (207) 465-9066.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

F. Firestopping:
   1. Provide firestopping where fire rated gypsum board assemblies butt masonry, joists, beams, and structural members as part of the gypsum board assembly work. See Division 07 Section "Fire-Resistive Joint Systems."
   2. Penetrations through fire-resistant rated walls and partitions by Divisions 21, 22, 23, 26, 27, and 28 work, including both empty openings and openings containing cables, pipes, ducts and conduits are specified as part of the Divisions 21, 22, 23, 26, 27, and 28 work. Sealing of penetrations shall be in accordance with Division 07 Section "Through-Penetration Firestop Systems."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

D. Post-Installation Inspection: Inspect walls for dents and imperfections, with Installer and painter present, prior to painting. Verify exposed joints are finished up to required heights (to above ceilings). Inspect wall again after primer and first coat of paint applied, with Installer and painter present. Installer shall touch-up as follows:
   1. Touch-up visible gypsum board imperfections before priming of walls.
   2. Touch-up imperfections found in field of boards and joints made visible from painting after first finish coat applied.
   3. Joint compound touch-up shall be primed and painted and viewed for acceptability before final coat is applied.

3.2 PREPARATION

A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
   1. Furnish devises to other trades for installation in advance of time needed for coordination and construction.

3.3 INSTALLING SUSPENSION SYSTEMS

A. Install suspension system components in sizes and spacings indicated on Drawings, but not less than those required by referenced installation standards for assembly types and other assembly components indicated.

B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

C. Suspend ceiling hangers from building structure as follows:
   1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or ceiling suspension system. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
   2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with the location of hangers required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
   3. Wire Hangers: Secure wire hangers by looping and wire-tying, either directly to structures or to inserts, eyescrews, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause them to deteriorate or otherwise fail.
   4. Do not connect or suspend steel framing from ducts, pipes, or conduit. Attach hangers to structural members.

D. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

E. Sway-brace suspended steel framing with hangers used for support.

F. For exterior ceilings (covered parking) and soffits, install cross bracing, framing and uplift posts to resist wind uplift, and limit deflection to l/240 that will prevent excessive movement that could cause joint cracking.

G. Wire-tie or clip furring channels to supports, as required to comply with requirements for assemblies indicated.

H. Install suspended steel framing components in sizes and spacings indicated, but not less than that required by the referenced steel framing and installation standards.
   1. Hangers: 48 inches o.c. maximum.
   2. Carrying Channels (Main Runners): 48 inches o.c.
   3. Furring Channels (Furring Members): 16 inches o.c.

I. Provide supplemental framing and supports for fixtures, including access panels and light fixtures.

J. Grid Suspension System: Attach perimeter wall track or angle where grid suspension system meets vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

3.4 INSTALLING MISCELLANEOUS STEEL FRAMING

A. Installation Standards: ASTM C 754, and ASTM C 840 requirements that apply to framing installation.
   1. Comply with requirements of UL assemblies indicated for fire-rated construction.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

B. Install steel resilient furring at the following spacings:
   1. Single-Layer Construction: 16 inches o.c., unless otherwise indicated.
   2. Multilayer Construction: 16 inches o.c., unless otherwise indicated.

C. Attach steel hat-shaped, rigid furring channels to framing with sound isolation clips in accordance with requirements of sound isolation clip manufacturer and UL assembly requirements.
   1. At Covered Parking where double layered gypsum is receiving a suspended gypsum ceiling, provide additional sound isolation clips to support total load of the floor/ceiling gypsum board assembly. Where anchors are attached through double layer gypsum board into furring channels, provide hat channels of sufficient gage to support assembly and resist wind forces.

3.5 INSTALLATION OF SOUND ATTENUATION BATTS

A. Install sound attenuation batts at locations indicated before installing gypsum panels, unless blankets are readily installed after panels have been installed on one side. Cut and fit tightly around obstructions, and fill voids with insulation. Remove projections that interfere with placement. Install insulation in voids as framing is installed that that would be inaccessible after completion of framing.

B. Install a single layer of insulation of required thickness to fill the full depth of cavity, unless otherwise shown. Where cavity requires insulation that is thicker than standard size, install next larger size and compress into cavity.

C. Hold batt insulation in place with insulation support anchors located at 5 feet on center full height of wall, starting at the top of each stud space.

D. Stuff glass fiber loose fill insulation into miscellaneous voids and cavity spaces. Fill box headers, and voids while framing is being erected that will be inaccessible for installation later. Compact to approximately 40 percent of normal maximum volume (to a density of approximately 2.5 pcf).

3.6 INSTALLATION OF GYPSUM BOARD SHAFT-WALL ASSEMBLIES

A. General: Install gypsum board shaft-wall assemblies to comply with requirements of fire-resistance-rated assemblies indicated, manufacturer's written installation instructions, and ASTM C 754 for installing steel framing.

B. Install supplementary framing in gypsum board shaft-wall assemblies around openings and as required for blocking, bracing, and support of gravity and pullout loads of fixtures, equipment, services, heavy trim, furnishings, and similar items that cannot be supported directly by shaft-wall assembly framing.
   1. At elevator hoistway door frames, provide jamb struts on each side of door frame.

C. At penetrations in shaft wall, maintain fire-resistance rating of shaft-wall assembly by installing supplementary steel framing around perimeter of penetration and fire protection behind boxes containing wiring devices, elevator call buttons, elevator floor indicators, and similar items.
   1. See Division 07 Section "Penetration Firestopping" for treatment of space around perimeter of penetration.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

D. Isolate gypsum finish panels from building structure to prevent cracking of finish panels while maintaining continuity of fire-rated construction.

E. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect, while maintaining fire-resistance rating of gypsum board shaft-wall assemblies.

F. Install perimeter fire stopping in accordance with Division 07 Section "Fire Resistive Joint Systems" and manufacturer's installation requirements for system contained in approved shop drawings. Seal gypsum board shaft walls with rated acoustical sealant at perimeter of each assembly where it abuts other work and at joints and penetrations within each assembly. Install acoustical sealant to withstand dislocation by air-pressure differential between shaft and external spaces; maintain an airtight and smoke-tight seal; and comply with ASTM C 919 requirements or with manufacturer's written instructions or ASTM C 919, whichever is more stringent.

G. In elevator shafts where gypsum board shaft-wall assemblies cannot be positioned within 4 inches of the shaft face of structural framing, floor edges, and similar projections into shaft, install 1/2- or 5/8-inch- thick, gypsum board cants covering tops of projections. No recesses allowed (at steel beams especially).
   1. Slope cant panels at least 75 degrees from horizontal. Set base edge of panels in adhesive and secure top edges to shaft walls at 24 inches o.c. with screws fastened to shaft-wall framing.
   2. Where steel framing is required to support gypsum board cants, install framing at 24 inches o.c. and extend studs from the projection to the shaft-wall framing.

H. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.7 APPLYING AND FINISHING PANELS, GENERAL

A. Gypsum Board Application and Finishing Standards: ASTM C 840 and GA-216, except as specified otherwise.
   1. Comply with requirements of UL assemblies indicated for fire-rated construction.
   2. Comply with requirements of STC assemblies indicated for sound-rated construction.

B. Install sound attenuation batt insulation, where indicated, before installing gypsum panels, unless batts are readily installed after panels have been installed on one side.

C. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in the central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member. Run gypsum board continuous on underside of trusses and resilient furring, before partitions are erected, unless indicated otherwise.

D. Install gypsum panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

E. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

F. Attachment to Steel Framing: Attach gypsum panels to steel studs so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

G. Attach gypsum panels to framing provided at openings and cutouts.

H. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members using resilient channels, or provide control joints to counteract wood shrinkage.

I. Form control joints with space between edges of adjoining gypsum panels.
   1. Where control joints are not shown, provide control joints at a maximum spacing of 30 feet; review proposed locations with Architect prior to commencement of work.

J. Cover both faces of stud partition framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
   1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
   2. Fit gypsum panels around ducts, pipes, and conduits.
   3. Where partitions intersect beams, joists, and other structural members projecting below underside of floor/roof construction, cut gypsum panels to fit profile formed by beams, joists, and other structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.
   4. Caulk fire-rated assemblies with fire-rated acoustical sealant on both sides of wall at head and sill to prevent the passage of smoke, gases and sound.
   5. Fire-resistance rated and STC rated joint designs shall maintain integrity throughout repetitive deflection cycles.
   6. Run board to within 1/4 inch of floor slabs to provide full support of resilient base.

K. Isolate perimeter of non-load-bearing gypsum board partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- wide spaces at these locations, and trim edges with casing bead edge trim where edges of gypsum panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
   1. Use fire-rated acoustical sealant for fire-rated walls.

L. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members, or provide control joints to counteract wood shrinkage.

M. STC-Rated Assemblies: Where STC-rated assemblies are indicated and at resident unit demising walls, seal construction at perimeters, behind control joints, and at openings and penetrations with continuous beads of acoustical sealant on both sides of wall at head and sill. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
   1. Exterior Walls: Install continuous bead of acoustical sealant at base of all exterior walls sealing between edge of gypsum panels and floor construction. Install continuous bead of paintable acoustical sealant at top of all exterior walls sealing between edge of gypsum panel and underside of floor slab. Tool material smooth and uniform to insure good contact and adhesion to substrate.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

N. Fire-Rated Assemblies: Where fire-rated assemblies are indicated, seal construction at perimeters and behind control joints with continuous beads of fire-rated acoustical sealant on both sides of wall at head and sill. Comply with ASTM E 1966 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
   1. Joints to receive sealant shall be clean and dry, free of dirt, dust and debris.

O. Space fasteners in gypsum panels according to referenced gypsum board application and finishing standard and manufacturer's written recommendations.
   1. Space screws a maximum of 12 inches o.c. for vertical applications.

P. Space fasteners in panels that are tile substrates a maximum of 8 inches o.c.

Q. Remove screws that do not hit studs, supports, or blocking and repair hole left by screw removal.

3.8 PANEL APPLICATION METHODS

A. Single-Layer Application:
   1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing, unless otherwise indicated.
   2. On partitions/walls, apply gypsum panels vertically (parallel to framing), unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
      a. Stagger abutting end joints not less than one framing member in alternate courses of board.
   3. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

B. Multilayer Application on Ceilings: Apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints 1 framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.

C. Multilayer Application on Partitions/Walls: Apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.

D. Single-Layer Fastening Methods: Apply gypsum panels to supports with steel drill screws.

E. Multilayer Fastening Methods: Fasten base layers and face layers separately to supports with screws.

F. Tile Backing Panels:
   1. Glass-Mat, Water-Resistant Backing Panel: Comply with manufacturer's written installation instructions and install at locations indicated to receive tile. Install with 1/4-inch gap where panels abut other construction or penetrations.
   2. Where tile backing panels abut other types of panels in the same plane, shim surfaces to produce a uniform plane across panel surfaces.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

3.9 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Install corner bead at external corners.

C. Install edge trim where edge of gypsum panels would otherwise be exposed. Provide edge trim type with face flange formed to receive joint compound, except where other types are indicated.
1. Install LC-bead (casing bead) where gypsum panels are tightly abutted to other construction and back flange can be attached to framing or supporting substrate.
2. Install L-bead where edge trim can only be installed after gypsum panels are installed.
3. Install U-bead where indicated.

D. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.
1. Review locations of control joints with Architect prior to start of gypsum panel installation.
2. For exterior ceilings, do not exceed 25 foot spacing in each direction.

3.10 FINISHING GYPSUM BOARD ASSEMBLIES

A. General: Treat gypsum board joints, interior angles, flanges of corner bead, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, beveled edges, and damaged surface areas using setting-type joint compound.

C. Apply joint tape over gypsum board joints and to flanges of trim accessories, except those with trim having flanges not intended for tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below, according to ASTM C 840, for locations indicated:
1. Level 1: At ceiling plenum areas, concealed areas, and where indicated, unless a higher level of finish is required for fire-resistance-rated assemblies and sound-rated assemblies.
2. Level 2: At ceiling plenum areas, concealed areas, and where indicated, for fire-resistance-rated assemblies, smoke assemblies and sound-rated assemblies.
3. Level 4: At panel surfaces that will be exposed to view, unless otherwise indicated.

E. Glass-Mat, Water-Resistant Backing Panels: Finish board forming base for ceramic and porcelain tile to comply with ASTM C 840 and according to manufacturer's written instructions for treatment of joints behind tile.

F. Exterior Ceilings and Soffits: Finish joints with fiberglass tape and setting type compounds to a Level 4 finish.

G. Where Level 1 gypsum board finish is indicated, embed tape in joint compound. Surface shall be free of excess joint compound.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

H. Where Level 2 gypsum board finish is indicated, fill fastener heads, embed tape in joint compound and apply thin coat of joint compound over all joints and interior angles.

I. For Level 4 gypsum board finish, embed tape in joint compound and apply first, fill (second), and finish (third) coats of joint compound over joints, angles, fastener heads, and accessories. Touch up and sand between coats and after last coat as needed to produce a surface free of visual defects and ready for decoration.
   1. At tapered edge joints, draw compound down to a level plane, leaving a monolithic surface that is flush with paper face. Finish coat shall be feathered a minimum of 8 inches beyond both sides of center of joint tape.
   2. At end-to-end butt joints, draw compound down to minimize hump created by joint tape application. Finish coat shall be feathered a minimum of 16 inches beyond both sides of center of joint tape.
   3. End product shall be a surface that appears level without telegraphing joint locations as high spots when viewed down wall after painting.
   4. Finish board to within 1/4 inch of floor, providing full support for resilient wall base without telegraphing joint.

3.11 FIELD QUALITY CONTROL

A. Above-Ceiling Observation: Before Contractor installs gypsum board ceilings, Architect will conduct an above-ceiling observation and report deficiencies in the Work observed. Do not proceed with installation of gypsum board to ceiling support framing until deficiencies have been corrected.
   1. Notify Architect seven days in advance of date and time when Project, or part of Project, will be ready for above-ceiling observation.
   2. Before notifying Architect, complete the following in areas to receive gypsum board ceilings:
      a. Installation of 80 percent of lighting fixtures, powered for operation.
      b. Installation, insulation, and leak and pressure testing of water piping systems.
      c. Installation of air-duct systems.
      d. Installation of air devices.
      e. Installation of mechanical system control-air tubing.
      f. Installation of above ceiling automatic fire suppression piping, including leak and pressure testing.
      g. Installation of ceiling support framing.
      h. Installation of fire stopping and acoustical sealant is complete.

3.12 CLEANING

A. Promptly remove any residual joint compound from adjacent surfaces.

3.13 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
   1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
   2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092950

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

SECTION 093100 - TILE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Ceramic mosaic tile.
2. Porcelain tile.
3. Glass tile.
4. Waterproof membrane.
5. Crack isolation membrane.
6. Metal edge strips installed as part of tile installations.

B. Related Sections:
1. Division 06 Section "Rough Carpentry" for shower seat framing.
2. Division 07 Section "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
3. Division 09 Section "Gypsum Board Assemblies" for glass-mat, water-resistant tile backer board.

1.3 DEFINITIONS

A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

1.5 INFORMATIONAL SUBMITTALS

A. Material Test Reports: For each tile-setting and -grouting product.

1.6 QUALITY ASSURANCE

A. Source Limitations for Tile: Obtain tile of each type and color or finish from one source or producer.
1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from one manufacturer and each aggregate from one source or producer.

C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer for each product:
   1. Waterproof membrane.
   2. Crack isolation membrane.
   3. Metal edge strips.

D. Preinstallation Conference: Conduct conference at Project site.
   1. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.
   2. Assemble all trades working at Project site to coordinate the work and to prevent workers from walking on newly installed tiles for required setting bed and grout cure times. Large tile will require additional time for mortar bed to cure. Contractor to coordinate project schedule to complete work by other trades and vacate areas receiving floor coverings, stopping pedestrian traffic over newly installed flooring installation until curing and drying period is complete. Contractor shall conduct periodic coordination meetings with all trades to review schedule and procedures to prevent interference and damage during installation and curing and drying periods of floor coverings.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

C. Store liquid materials in unopened containers and protected from freezing.

D. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.
   1. Maintain temperatures at 50 deg F or more in tiled areas during installation and for 7 days after completion, unless higher temperatures are required by referenced installation standard or manufacturer's instructions.

B. Vent temporary heaters to exterior to prevent damage to tile work from carbon dioxide buildup.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1. Provide tile complying with Standard grade requirements unless otherwise indicated.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCA installation methods specified in tile installation schedules, and other requirements specified.

C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

D. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.

2.2 TILE PRODUCTS

A. Porcelain Tile, T-01: Glazed porcelain tile as follows:
1. Composition: Porcelain.
2. Face Size: 12 inches by 24 inches.
3. Thickness: 3/8 inch ±.
4. Product: Best Tile; Scotia.
a. As indicated in Finish Legend.

B. Porcelain Tile, T-02 & WT-02: Flat porcelain tile as follows:
1. Composition: Porcelain.
2. Face Size: 12 inches by 24 inches.
3. Thickness: 3/8 inch ±.
4. Face: Plain with square edges.
5. Trim Unit, CB-01: Straight trim with bullnose top, 3- by 24-inches.
6. Product: Zera Annex; Rectified Porcelain Tile; distributed by Anatolia Tile & Stone, Inc.
a. Color: As indicated in Finish Legend.

C. Porcelain Tile, T-03: Glazed porcelain tile as follows:
1. Composition: Porcelain.
2. Face Size: 12 inches by 24 inches.
3. Thickness: 9 mm.
4. Face: Plain with square edges.
5. Trim Unit, CB-02: Straight trim with bullnose top, 3- by 13-inches.
6. Product: Florida Tile; Soul.
a. Color: As indicated in Finish Legend.

D. Porcelain Tile, T-04: Flat porcelain tile as follows:
1. Composition: Porcelain.
2. Face Size: 6 inches by 36 inches.
3. Thickness: 10 mm.
4. Face: Plain with square edges.
5. Product: Arizona Tile; Waterfall Series (WF).
a. Color: As indicated in Finish Legend.

E. Porcelain Tile, T-05: Factory-mounted, unglazed ceramic mosaic tile.
1. Composition: Porcelain.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

2. Module Size: 1 inch by 1 inch.
3. Sheet Size: 12 inches by 24 inches.
4. Thickness: 1/4 inch.
5. Face: Plain with cushion edges.
6. Trim Unit, CB-05: Cove base, Style C-813, with manufactured inside and outside corners. Provide radius corner trim (stretcher units) for shower curbs.
7. Product: American Olean; Unlazed Colorbody Porcelain Mosaics.
   a. Color: As indicated in Finish Legend.

F. Porcelain Wall Tile, WT-01:
1. Composition: Porcelain.
2. Face Size: Nominal 12 inches by 24 inches.
3. Thickness: 9.5 mm.
4. Face: Plain with square edges.
5. Product: Refin Ceramiche; Wood2.
   a. Color: As indicated in Finish Legend.

G. Porcelain Wall Tile, WT-03 & WT-04: Factory-mounted, glass mosaic tile.
1. Product: FINE; Lighthouse; distributed by Galleria Stone and Tile.
   a. Colors: As indicated in Finish Legend.

2.3 WATERPROOF MEMBRANE FOR THIN-SET TILE INSTALLATIONS

A. General: Manufacturer's standard product that complies with ANSI A118.10 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

B. Bonded Waterproof Membrane: Polyethylene faced on both sides with fleece webbing; 0.008-inch nominal thickness.
1. Product: Schluter Systems L.P.; KERDI and associated preformed sections for inside and outside corners, pipe protrusions and mixing valve openings and waterproofing membrane strips.

C. Fabric-Reinforced, Fluid-Applied Membrane: System consisting of liquid-latex rubber or elastomeric polymer and continuous fabric reinforcement.
1. Products: Subject to compliance with requirements, provide one of the following:
   a. Laticrete International, Inc.; Laticrete 9235 Waterproof Membrane.
   b. MAPEI Corporation; Mapelastic AquaDefense with MAPEI Fiberglass Mesh.

2.4 CRACK ISOLATION MEMBRANE FOR THIN-SET TILE INSTALLATIONS

A. General: Manufacturer's standard product that complies with ANSI A118.12 for standard performance and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

B. Fabric-Reinforced, Fluid-Applied Membrane: System consisting of a two-part, liquid rubber and fabric reinforcement.
1. Products: Subject to compliance with requirements, provide the following :
   a. Laticrete International, Inc.; Laticrete Blue 92 Anti-Fracture Membrane.
   b. MAPEI Corporation; Mapelastic AquaDefense with with MAPEI Fiberglass Mesh.
2. Location: Use under tile having a dimension 6 inches or larger.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

a. Provide on all floor cracks and saw cuts.

2.5 PREFABRICATED SHOWER COMPONENTS

A. Prefabricated Shower Base: Trapezoid-imprinted, prefabricated, sloped tiled shower tray base, made of 2.75 lb/cu. ft. density, self-extinguishing, expanded polystyrene, with 12-5/16 inch diameter removable recessed section with 1/8 inch wide ribs on top and channels on the underside.
1. Size: 32 inches by 60 inches.
2. Product: Schluter Systems L.P.; KERDI-SHOWER-ST.

B. Prefabricated Shower Curb: Trapezoid-imprinted, prefabricated, tiled shower curb base, made of 2.75 lb/cu. ft. density, self-extinguishing, expanded polystyrene. Curb dimensions are 48 inch x 6 inch x 4-1/2 inch.
1. Product: Schluter Systems L.P.; KERDI-SHOWER-SC.

C. Drain for System for Prefabricated Shower Pan: floor drain 11-13/16 inch diameter, trapezoid-perforated, sloped integrated bonding flange with thermally laminated polypropylene fleece and grate assembly. Grate assembly includes grate, height adjustment collar, and lateral adjustment ring with trapezoid perforations. Drain listed by UPC to meet requirements of "International Association of Plumbing and Mechanical Officials Interim Guide Criteria for Floor Drain with Integrated Bonding Flange" (IGC 195), and referenced in method B422 of the Tile Council of North America Handbook for Ceramic Tile Installation.
1. Drain Housing Material: PVC; coordinate with plumbing contractor prior to ordering.
2. Grate Material and Finish: Stainless steel.
3. Nominal Grate Size: 6 inch square.
4. Drain Outlet: 2 inch; coordinate with plumbing contractor prior to ordering.
5. Product: Schluter Systems L.P.; KERDI-DRAIN.

D. Recessed Shower Niche: Schluter Kerdi-Board SN, 12 inch by 12 inch by 3-1/2 inches.

E. Sealant for Bonded Waterproof Membrane System: Single-component, elastomeric, waterproof sealing and bonding compound with a silane-modified polymer base.
1. Product: Schluter Systems L.P.; KERDI-FIX; color as selected by Architect at exposed locations.

2.6 SETTING MATERIALS

A. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4.
1. Provide prepackaged, dry-mortar mix combined with acrylic resin liquid-latex additive at Project site.
   a. For wall applications, provide mortar that complies with Paragraph F-4.6.1 in addition to the requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.
2. Provide white mortar for glass mosaic tile.

B. Latex-Portland Cement Mortar for Large Format Tile, Medium Set on Floors: ANSI A118.4. Provide product that is approved by manufacturer for application thickness of up to 3/4 inch without shrinkage for tile with a dimension of 12-inches or larger.
1. Provide prepackaged, premium dry-mortar mix containing a polymer additive.
   a. Products:
      1) LATICRETE; Laticrete 255 MultiMax.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

2) MAPEI; Ultraflex LFT.

C. Latex-Portland Cement Mortar for Large Format Tile and Stone, Medium Set on Walls: ANSI A118.4. Provide product that is approved by manufacturer for application thickness of up to 3/4 inch without shrinkage for tile with a dimension of 12-inches or larger.
1. Provide prepackaged, premium dry-mortar mix containing a polymer additive.
a. For wall applications, provide mortar that complies with Paragraph F-4.6.1 in addition to the requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.
b. Products:
1) LATICRETE; Laticrete 255 MultiMax.
2) MAPEI; Ultraflex LFT.

2.7 GROUT MATERIALS

A. Chemical-Resistant, Water-Cleanable Epoxy Grout: ANSI A118.3.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Flexcolor CQ by MAPEI Corporation or comparable product by the following:
a. Laticrete International, Inc.
2. Color: As indicated in Finish Legend; in locations not indicated, as selected by Architect from manufacturer's full range of colors.

2.8 ELASTOMERIC SEALANTS

A. Sealants: Same manufacturer as grout to match color. Mapei Mapesil, Laticrete Latasil.
1. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints unless otherwise indicated.

2.9 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. Metal Edge Strips for Floors: Stainless steel transition strip for transitioning from tile to lower profile floor covering; transition strip shall have integral provision for anchorage to mortar bed.
1. Locations: Provide at tile to carpet locations and where indicated.
2. Product: Schluter Systems; Schluter Reno-TK, stainless steel with brushed finish.

C. Metal Transition Strips at Outside Corners of Wall Tile: Stainless steel with brushed finish, 1/8-inch wide at top edge with integral provision for anchorage to mortar bed or substrate unless otherwise indicated; height as required for transitioning from tile to adjacent material.
1. Product: Schluter Systems; Schluter-JOLLY.

D. Temporary Protective Coating: Where recommended by tile manufacturer, provide the product type indicated below that is formulated to protect exposed surfaces of tile against adherence of mortar and grout; compatible with tile, mortar, and grout products; and easily removable after grouting is completed without damaging grout or tile.
1. Grout release in form of manufacturer's standard proprietary liquid coating that is specially formulated and recommended for use as temporary protective coating for tile.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

E. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

2.10 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions, including those for accurate proportioning of materials, water, or additive content; type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other procedures needed to produce mortars and grouts of uniform quality with optimum performance characteristics for application indicated.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
   1. Check flatness of substrate by laser. Level floor to provide a base for thin set that allows for a smooth, flat floor without irregularities. Grinding high spots until substrate is acceptable to the flooring Installer is specified in Division 03 Section "Cast-In-Place Concrete".
   2. Verify that substrates for setting tile are firm, dry, clean, free of coatings that are incompatible with tile-setting materials including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
   3. Verify that concrete substrates for tile floors installed with thin- or medium-set mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.
      a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
      b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
   4. Verify that gypsum board substrates for wall tile comply with the surface finish requirements in ANSI A108.01 for installations indicated and the following:
      a. For Tile with all Edges less than 15 Inches: Flatness shall not vary more than 1/4-inch in 10 feet with no more than 1/16-inch variation in 12 inches when measured from the high points in the surface.
      b. For Tile with at Least One Edge 15 Inches or Greater: Flatness shall not vary more than 1/8-inch in 10 feet with no more than 1/16-inch variation in 24 inches when measured from the high points in the surface.
      c. Verify that substrate is properly supported in corners.
      d. Verify that fasteners are properly spaced and covered.
      e. Verify that joint treatment is fully cured.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

5. Verify that installation of anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove coatings, including curing compounds and other substances that contain soap, wax, oil, or silicone, that are incompatible with tile-setting materials.

B. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thin- or medium-set mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

D. Field-Applied Temporary Protective Coating: If recommended by tile manufacturer prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

3.3 TILE INSTALLATION

A. Comply with TCA's "Handbook for Ceramic Tile Installation" for TCA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 Series "Specifications for Installation of Ceramic Tile" that are referenced in TCA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
   1. For the following installations, follow procedures in the ANSI A108 Series of tile installation standards for providing 95 percent mortar coverage:
      a. Tile floors in wet areas.
      b. Tile floors composed of tiles 8 by 8 inches or larger.

B. Lay tile in patterns indicated. When field conditions conflict with indicated pattern, notify Architect in writing prior to installation for review and approval of revisions.

C. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

D. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile. Top setting of coved base is not permitted.

E. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.

F. Tile shall lay flat and each edge flush with adjacent tile, free of tilting and skewed tile. Provide additional setting material to shim accent tiles that are thinner than field tiles so face is in same plane.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

G. Jointing Pattern: Lay tile in patterns indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
   1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
   2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
   3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.

H. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:
   1. Ceramic Mosaic Tile: 1/16 inch.
   2. Porcelain Tile: 1/4 inch on floor; 1/16 inch on wall.
   3. Glass Tile: Match joint thickness of joints in tile mounted sheets.

I. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

J. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
   1. Locate expansion joints in accordance with approved Shop Drawings and the TCNA Handbook and as follows:
      a. Interior Floors on Grade: 20 to 25 feet in each direction.
      b. Interior Elevated Slabs: 8 to 12 feet in each direction.
      c. Interior Walls: 20 to 25 feet in each direction.
      d. In areas exposed to direct sunlight or moisture, space joints not greater than 8 to 12 feet in each direction.
   2. Locate expansion joints in accordance with approved Shop Drawings.
   3. Prepare joints and apply sealants to comply with installation requirements in Division 07 Section "Joint Sealants."

K. Metal Edge Strips: Install at locations indicated and where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile.
   1. Scribe ends of transition strip to door frame profile at jambs, providing tight joint at transition strip and frame interface. Install transition strip in one piece, full width of opening.

L. When recommended by tile manufacturer, apply coat of temporary protective coating to tile prior to setting tile.

3.4 INSTALLATION OF BONDED WATERPROOF MEMBRANE SYSTEM IN SHOWERS

A. Install bonded waterproofing to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness and bonded securely to substrate.

B. Drain and Shower Base Installation: Prepare substrate for drain assembly in accordance with manufacturer's written instructions. Apply thin set mortar to substrate and to top and bottom of the detached center section of the prefabricated shower base. Slide the center section into place below the drain to ensure solid and uniform support of the drain bonding flange. Apply thin-set mortar to the substrate and install the prefabricated shower pan, solidly embedding it in the

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

mortar. Check underside of the base to ensure full coverage and support. Install drain clamping ring in accordance with manufacturer's written instructions.

C. Installation of Shower Curb: Apply thin-set mortar to floor and to edge of the prefabricated shower pan. Set prefabricated shower curb into mortar, pressing firmly into place; install level. Check underside of the curb to ensure full coverage and support.

D. Waterproofing Shower Base: Apply thin-set mortar to drain bonding flange and surrounding shower base. Embed bonded waterproofing membrane onto the drain bonding flange and shower base to ensure full coverage and remove air pockets. Carry the membrane onto the step in the bonding flange of the drain and to the edges of the shower base. Use same process to cover the shower curb and shower seat. Seams in the waterproofing membrane shall be constructed by abutting adjacent sheets and installing waterproofing strips, 5 inches wide, centered over the joint. At floor-to-wall transitions, embed a waterproofing strip, 10 inches wide, running up the wall 4 inches. Install preformed waterproofing corners at all inside and outside corners. Install drain grate in accordance with manufacturer's written instructions; protect visible surfaces of grate frame and grate for contact with setting and grouting materials. Setting and grouting materials shall be removed immediately for visible surfaces.

E. Recessed Shower Niche: Coordinate rough opening frame requirement for recessed shower niche. Cut opening in tile backer board and shim integrated bonding flange flush with wall surface. Tie flange into wall waterproofing.

F. Installation of Waterproofing on Shower Walls: Clean substrate of any dust or other debris. Thin set bonded waterproofing to substrate butting joints in membrane and lapping over waterproofing applied to shower base. All seams in bonded waterproofing shall be covered with an embedded waterproofing strip, 5 inch wide. Protrusions, such as mixing valves and shower heads, through the membrane shall be sealed with KERDI-FIX.

G. Shower Seat: Coordinate shower seat framing and support details with Architect. Apply tile underlayment set in mortar to riser and seat. Install waterproofing to seat and riser, tying into wall and floor waterproofing. Install tile to seat riser and coordinate installation of solid surfacing seat finish to detail.

H. Water Test: Prior to commencement of tile installation, shower waterproofing membrane installation shall be tested in accordance with ASTM D 5957. Wait a minimum of 24 hours after installation of bonded waterproof membrane system to allow for final set of thin-set mortar and to ensure waterproof performance of seams and connections before testing system.

3.5 WATERPROOFING INSTALLATION

A. Install waterproofing to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness and bonded securely to substrate.
   1. Turn membrane up walls as follows to keep water from traveling under partitions:
      a. Bathrooms: 2 inches minimum at perimeter walls of rooms.

B. Do not install tile or setting materials over waterproofing until waterproofing has cured and been tested to determine that it is watertight.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

3.6 CRACK ISOLATION MEMBRANE INSTALLATION

A. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness and bonded securely to substrate.

B. Do not install tile or setting materials over crack isolation membrane until membrane has cured.

3.7 CLEANING AND PROTECTING

A. Cleaning: On completion of placement and grouting, clean all tile surfaces so they are free of foreign matter.
   1. Remove epoxy and latex-portland cement grout residue from tile as soon as possible.
   2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
   3. Remove temporary protective coating by method recommended by coating manufacturer and that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent
   4. drain clogging.

B. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.

C. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

D. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.8 TILE INSTALLATION SCHEDULE

A. Tile in Showers:
   1. Ceramic Tile in Shower Receptor over Concrete Floors: Reinforced cement mortar over waterproof membrane, turn waterproof membrane up wall, TCA B420.
   2. Ceramic Tile in Shower Receptor over Gypsum Cement Underlayment with Occupied Rooms Below: Thin-set latex-portland cement mortar over bonded waterproofing membrane over preformed shower base, TCA B422 modified.
   3. Large Format, Porcelain Wall Tile on Glass-Mat, Water Resistant Backer Board in Showers: Medium set latex-portland cement mortar over bonded waterproofing membrane, lap waterproofing membrane over receptor waterproofing membrane, TCA B422.
   4. Provide metal transition strips with mitered corners at perimeter outside corners of tile recessed shower niche.

B. Large Format, Porcelain Wall Tile on Glass-Mat, Water Resistant Backer Board - Bathtubs: Medium set latex-portland cement mortar over bonded waterproofing membrane, TCA B430.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

C. Large Format, Porcelain Wall Tile on Glass-Mat, Water Resistant Backer Board: Medium set, latex portland cement mortar tile setting bed, TCA W245.

D. Glass Mosaic Tile on Glass-Mat, Water Resistant Backer Board: Latex portland cement mortar tile setting bed and unsanded grout, TCA W245.
   1. Provide white mortar.

END OF SECTION 093100

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

SECTION 095113 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Acoustical panels.
   2. Exposed suspension systems.

B. Related Sections include the following:
   1. Divisions 21, 22, 23 and 26 Sections for coordination of air handling devices, fire protection devices, and electrical devices installed in ceiling systems.

1.3 DEFINITIONS

A. CAC: Ceiling Attenuation Class.

B. NRC: Noise Reduction Coefficient.

1.4 SUBMITTALS

A. General: Submit in accordance with Division 01 Section "Submittals Procedures."

B. Product Data: For each type of product indicated.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each acoustical panel ceiling.

D. Research/Evaluation Reports: For each acoustical panel ceiling and components and anchor and fastener type, from ICC-ES.

E. Maintenance Data: For finishes to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Source Limitations:
   1. Acoustical Ceiling Panel: Obtain each type through one source from a single manufacturer.
   2. Suspension System: Obtain each type through one source from a single manufacturer.

B. Fire-Test-Response Characteristics: Provide acoustical panel ceilings that comply with the following requirements:
   1. Surface-Burning Characteristics: Provide acoustical panels with the following surface-burning characteristics complying with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84:
      a. Smoke-Developed Index: 50 or less.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes. Store materials flat.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Complete installation of mechanical, electrical, and other utility services above ceiling plane prior to installation of ceilings.

1.8 COORDINATION

A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 ACOUSTICAL PANELS, GENERAL

A. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.
   1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface per ASTM E 795.
   2. Test Method for Ceiling Attenuation Class (CAC). Where acoustical panel ceilings are specified to have a CAC, provide units identical to those tested per ASTM E 1414 by a qualified testing agency.

B. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical panels treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

2.2 ACOUSTICAL PANELS FOR ACOUSTICAL PANEL CEILING

A. Acoustic Panel, SAT-01:
   1. Size: 24 inches x 48 inches.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

2. Thickness: 5/8-inch thick.
3. Composition: Mineral wool fiber.
4. Surface Finish: Vinyl paint; white.
5. Surface Texture: Medium textured.
6. Edge: Square.
7. NRC Range: 0.55.
8. CAC Range: 35.
9. Fire Hazard Classification: Class A, 0 - 25 flame spread.
10. Dimensional Stability: Sag resistant at high humidity.
11. Product: Armstrong World Industries, Inc.; Cortega No. 769.
12. Suspension System Type: A.

B. Acoustic Panel, SAT-02:
1. Size: 24 inches x 96 inches.
2. Thickness: 7/8-inch thick.
3. Edge Condition: Access kerf edge.
4. Composition: Mineral wool fiber.
5. Surface Finish: Vinyl paint; white.
6. Surface Texture: Fine textured.
7. NRC Range: 0.90.
8. Fire Hazard Classification: Class A, 0 - 25 flame spread.
9. Dimensional Stability: Sag resistant at high humidity.
10. Antimicrobial Treatment: Coating based, front and back.
11. Product: Armstrong World Industries, Inc.; Optima Vector, No. 3907.
12. Suspension System Type: A.

2.3 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.

B. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.

C. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated.

D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
2. Size: Select wire diameter so its stress at 3 times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch- diameter wire.

2.4 METAL SUSPENSION SYSTEM FOR ACOUSTICAL PANEL CEILING

A. Type A, Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, not less than G30 coating designation, with prefinished 15/16-inch- wide metal caps on flanges.

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1. Structural Classification: Intermediate-duty system.
2. End Condition of Cross Runners: Override (stepped) type.
3. Face Design: Flat, flush.
4. Cap Material: Steel cold-rolled sheet, as standard with manufacturer.
5. Cap Finish: Painted white.
6. Products:
   a. Armstrong World Industries, Inc.; Prelude Exposed Tee System, 7300 Series.
   b. Chicago Metallic Corporation; 1200 System.
   c. USG Interiors, Inc.; DX System.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION

A. General: Install acoustical panel ceilings to comply with ASTM C 636 and seismic design requirements indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

B. Suspend ceiling hangers from building's structural members and as follows:
   1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
   2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
   3. Splay hangers only where required and, if permitted with fire-resistance-rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
   4. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
   5. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

6. Space hangers not more than 48 inches o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
7. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
8. Exposed pop rivets for grid alignment purposes shall not be permitted.

C. Suspension system shall be reinforced to support diffusers, light fixtures and any additional members. Install hanger wires to grid at each corner of light fixtures. Coordinate location with electrical and other trades.
1. Each individual fixture and attachment with combined weight of 56 lbs. or less shall have two 12-gage wire hangers attached at diagonal corners of the fixture; wires shall be slack. Fixtures and attachments with a combined weight of greater than 56 lbs. shall be independently supported from the structure at all four corners.

D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
1. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
2. Do not use exposed fasteners, including pop rivets, on moldings and trim.

E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
1. Arrange directionally patterned acoustical panels to run in the same direction, unless otherwise indicated.
2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.
3. For access kerf-edge panels, install in accordance with manufacturer's written instructions; install with 1/4-inch reveal, clip per manufacturer's requirements.
4. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
5. Install hold-down clips in areas indicated, in areas required by authorities having jurisdiction, and for fire-resistance ratings; space as recommended by panel manufacturer's written instructions, unless otherwise indicated.

3.4 CLEANING

A. Acoustical Panel Ceilings: Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095113

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

SECTION 096400 - WOOD FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Factory-finished wood flooring.
2. Quarter round trim, transition strips and T-moldings.

B. Related Sections:
1. Division 06 Section "Finish Carpentry" for wood base.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For each type of floor assembly and accessory. Include plans, elevations, sections, details, and attachments to other work. Include expansion provisions and trim details.

C. Samples for Verification: For each type of wood flooring and accessory, with stain color and finish required, approximately 12 inches long and of same thickness and material indicated for the Work and showing the full range of normal color and texture variations expected. Submit transition strips for each type of edge condition for approval.

D. Maintenance Data: Methods for maintaining flooring, including recommended cleaning products. Precautions for cleaning materials and methods that could be detrimental to finishes and performance.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver wood flooring materials in unopened cartons or bundles, each bearing names of product and manufacturer. Project identification, and shipping and handling instructions.

B. Protect wood flooring from exposure to moisture. Do not deliver wood flooring until after ceramic tile, drywall, painting and similar wet work is complete and dry.

C. Store wood flooring materials in a dry, warm, ventilated, weathertight location and elevated not less than 4 inches above the floor in accordance with the manufacturer's written instructions for storage. The storage environment shall be maintained at a 30 to 55 percent relative humidity and a temperature between 60 and 90 deg F.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1.5 PROJECT CONDITIONS

A. Conditioning period begins not less than fourteen days before wood flooring installation, is continuous through installation, and continues not less than seven days after wood flooring installation.
   1. Environmental Conditioning: Maintain an ambient temperature between 60 and 90 deg F and relative humidity between 35 and 55 percent in spaces to receive wood flooring during the conditioning period.
   2. Wood Flooring Conditioning: Move wood flooring into spaces where it will be installed, no later than the beginning of the conditioning period.
      a. Do not install flooring until it adjusts to relative humidity of, and is at same temperature as, space where it is to be installed.
      b. Open sealed packages to allow wood flooring to acclimatize immediately on moving flooring into spaces in which it will be installed.

B. After conditioning period, maintain relative humidity and ambient temperature planned for building occupants.

C. Install factory-finished wood flooring after other finishing operations, including painting, have been completed.

1.6 WARRANTY

A. Special Warranty for Wood Flooring: Manufacturer agrees to repair or replace components of acrylic impregnated wood flooring and hardwood floor moldings and accessories shall be warranted against wear-out of acrylic impregnated wear surface and structural defect within specified warranty period. Warranty shall include cost of labor cost for repair or replacement for the first five years.
   1. Wear-out of acrylic impregnated wear surface shall be defined as the complete removal of the wear surface down to the first glue layer of the laminate flooring product.
   2. Structural defect shall be defined as the separation of any ply within a multi-ply construction and any glue separation of solid hardwood flooring accessories.
   3. Warranty Period: Limited Lifetime Warranty.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

2.2 FACTORY-FINISHED WOOD FLOORING

A. Engineered-Wood Flooring, HWD-01: HPVA EF.
   1. Product: Mohawk Industries; Performance Plus Hardwood Flooring.
   2. Construction: Engineered, five-ply laminated construction.
   3. Top Layer Species: Maple.
   4. Total Thickness: 3/8 inch.
   5. Construction: Five plies plus wear layer.
   6. Face Width: 5 inches.
   7. Length: Varying lengths to 48 inches.
   8. Edge and End Style: Rolled.

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

9. Accessories: Reducer strips and quarter round shoe matching flooring.
   a. Wood to Carpet and Wood to Tile Transition: T-molding, species and finish to match flooring.
10. Finish: ArmorMax Aluminum Oxide Finish with ScotchGard, Matte gloss finish.
    a. Color: As indicated in Finish Legend.

2.3 INSTALLATION ACCESSORY MATERIALS

A. Acoustical Underlayment:
   1. Polyethylene Flooring Underlayment: Mohawk moistureGuard, .118 inch thick, 3.6 pcf density polyethylene foam underlayment with 2 mil polyethylene film moisture barrier.
      a. Location: Over floor areas with radiant heat.
   2. Cork Underlayment: WE Cork Warm & Quiet, 3mm thick, 10 pcf density cork with polyurethane binder.
      a. Location: Over all floor areas except at radiant heat locations.

B. Wood Flooring Tongue and Groove Adhesive: Mohawk Performance Accessory Tongue & Groove D# Rated Floating Floor Glue.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas and conditions, with Installer present, for compliance with requirements for maximum moisture content, installation tolerances, environmental conditioning, and other conditions affecting performance of wood flooring.

B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of products.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

D. For Gypsum Cement Underlayment: An independent testing agency shall verify the dryness of the underlayment using a GE Protimeter with either Surveymaster or Aquant model. A reading of 180 or less on the moisture meter indicates less than 1 percent moisture content and suitable dryness for flooring.

3.2 PREPARATION

A. Broom or vacuum clean substrates to be covered immediately before product installation. Remove paint and materials that could affect underlayment installation.

B. Measure each flooring area and establish layout to balance border widths at opposite edges of each floor. Avoid using flooring board at borders less than 1 inch wide. Allow 3/8-inch expansion around all vertical obstructions. Undercut door casings to permit flooring placement beneath for expansion.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

3.3 INSTALLATION

A. Install acoustical underlayment over all floor areas receiving wood flooring. Adhere in place to prevent displacement during installation, and subsequent movement in wood flooring system.

B. Comply with flooring manufacturer's written installation instructions.

C. Provide 3/8-inch expansion space at walls and other obstructions and terminations of flooring.

D. Engineered-Wood Flooring, General Installation Requirements.
1. Flooring shall be installed from several cartons at the same time to ensure good color and shade mixture.
2. Preselect and set aside boards that blend best with all horizontally mounted moldings such as reducer strips and T-moldings to ensure a uniform final appearance. Install these boards adjoining the moldings.
3. Stagger the ends of boards at least 6 inches to 8 inches between adjacent rows.
4. Avoid staggering the rows uniformly to prevent stair-stepping. Boards cut from the opposite end of the row may be used for the next starter boards.
5. Maintain a minimum 3/8-inch expansion around perimeter of room and all vertical obstructions.

E. Engineered-Wood Flooring, Floating Floor Installation: Install flooring in accordance with manufacturer's written instructions.
1. Align first row with the wall using wedges to maintain 2/8-inch expansion in place and to stabilize the product. If the wall is not straight, scribe first board as necessary to maintain alignment.
2. Select a board to begin installation of the first row using the longest boards available.
3. Starting from the left with the tongue facing the wall, carefully place the first board in place. Use wedges or scrap along the wall to hold plank in place while allowing the required expansion space.
4. Align the next piece by overlapping the end of the first board so that the joint is tight when the board lays flat. Some slight adjustment of the board may be necessary to assure a tight fit. Place wedges or scrap as necessary to restrain movement and maintain expansion zone.
5. Continue in this manner until the first row is complete. Cut the final board to length allowing the necessary expansion zone. Place wedges to restrain movement and maintain expansion zone.
6. Begin second row with the cut piece from the first row. If the cut piece is shorter than 8 inches do not use it. Instead, begin with a new board that exceeds 8 inches in length and allows between 6 and 8 inches spacing between the end joints.
7. Apply adhesive at manufacturer’s recommended quantity to every plank along the topside of the groove and bottom side of the tongue for the full length of the side and end.
8. Install the first three rows with tight side and end joints. Tap with a tapping block to assure plank is tight to adjacent row.. Restrain the movement of the board by installing a wedge in the expansion zone. End joints shall be staggered 6 inches minimum.
9. Maintain flooring in straight line without bow. Stretch and stick low adhesion delicate surface painters tape across every 3 to 5 rows of planks spaced approximately 2 feet apart to hold flooring in proper position until glue sets.
10. Clean exposed glue from joints and surface while adhesive is wet per manufacturers requirements.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

11. Install all remaining boards and rows in the same manner.
12. Cut the last board to size, allowing for the expansion zone, and install as above. If necessary, complete the tight fit by tapping the board into place with a pull bar.
13. Maintain 6 to 8 inch spacing between end joints after the first four rows.
14. Trim all underlayment and install or re-install any transition pieces, reducer strips, T-molding, thresholds, and trim that may be needed or as specified.

F. Wood Trim: Provide edge transition trim as required for each type of edge condition. Install quarter round at perimeter of flooring. Cope inside corners and miter outside corners. Where ends of quarter round projects out beyond face of trim, miter projecting edge, stain and finish to match face of quarter round using manufacturer recommended topcoat.

3.4 PROTECTION

A. Protect installed wood flooring during remainder of construction period with covering of heavy kraft paper or other suitable material. Do not use plastic sheet or film that might cause condensation. Make sure floor has been thoroughly cleaned prior to installing protective covering to prevent scratches to finish.
   1. Do not move heavy and sharp objects directly over kraft-paper-covered wood flooring. Protect flooring with plywood or hardboard panels to prevent damage from storing or moving objects over flooring.

END OF SECTION 096400

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

SECTION 096500 - RESILIENT FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Vinyl composition floor tile.
2. Resilient base.

1.3 SUBMITTALS

A. General: Submit in accordance with Division 01 Section "Submittals Procedures."

B. Product Data: For each type of product indicated.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver resilient flooring materials and installation accessories to Project site in original manufacturer's unopened cartons and containers each bearing name of product and manufacturer, Project identification, and shipping and handling instructions.

B. Store resilient flooring and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 70 deg F or more than 80 deg F. Store floor tiles on flat surfaces and rolls upright.

1.5 PROJECT CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 80 deg F, in spaces to receive resilient flooring during the following time periods:
1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 80 deg F.

C. Close spaces to traffic during resilient flooring installation.

D. Close spaces to traffic for 48 hours after floor tile installation.

E. Install resilient flooring after other finishing operations, including painting, have been completed.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

PART 2 - PRODUCTS

2.1 VINYL COMPOSITION FLOOR TILE

A. Vinyl Composition Floor Tile, VCT-01: ASTM F 1066.
   1. Product: Azrock, Inc.; Standard VCT.
   2. Class: Class 2, through-pattern tile.
   3. Wearing Surface: Smooth.
   4. Thickness: 0.125 inch.
   5. Size: 12 by 12 inches.
   6. Colors and Patterns: As selected by Architect from manufacturer's full range of colors.

2.2 RESILIENT WALL BASE

A. Resilient Base: ASTM F 1861.
   1. Product: Johnsonite; Vinyl Wall Base.
   2. Material Requirement: Type TV (vinyl, thermoplastic).
   3. Manufacturing Method: Group I (solid, homogeneous).
   4. Style: Cove (base with toe).
   5. Minimum Thickness: 0.125 inch.
   6. Height: 4 inches.
   7. Lengths: Coils in manufacturer's standard length.
   8. Outside Corners: Job formed.
   9. Inside Corners: Job formed.
   10. Color: As selected by Architect from manufacturer's full range of options.

2.3 INSTALLATION MATERIALS

A. Concrete Slab Primer: Nonstaining type as recommended by flooring adhesive manufacturer.

B. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.
   1. Product: Ardex; SD-F Feather Finish.

C. Adhesive for VCT: Premium moisture-resistant, pressure-sensitive adhesive suitable over new concrete substrates as recommended by manufacturer to suit floor tile and substrate conditions indicated.
   1. Maximum Allowable RH: 80 percent RH as measured by ASTM F 2170.
   2. Product: Azrock, Inc.; Azrock 100 Clear Thin Spread Adhesive.

D. Adhesive for Vinyl Base: Premium, solvent-free, acrylic water-based adhesive suitable for substrate conditions indicated and as recommended by manufacturer to suit vinyl wall base.
   1. Product: Johnsonite; 960 Cove Base Adhesive.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

C. Proceed with installation only after unsatisfactory conditions have been corrected.
1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

3.3 Concrete Substrates: Prepare according to ASTM F 710 and the following:
1. Verify that substrates are dry and free of curing compounds, sealers, hardeners, and other materials whose presence would interfere with bonding of adhesive.
2. Determine adhesion and dryness characteristics by performing bond, moisture and pH level tests recommended by flooring manufacturer and adhesive manufactures.

B. Remove substrate coatings, paint, joint compound and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate. Prime substrate as required by the adhesive manufacturer to comply with surface prep and PH requirements.

D. Do not install resilient flooring until it is same temperature as space where it is to be installed.
1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

E. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.4 RESILIENT FLOORING INSTALLATION, GENERAL

A. Install in accordance with manufacturer's written instructions and requirements of this Section.

B. Scribe, cut, and fit flooring to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, edgings, door frames, thresholds, and nosings.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

C. Extend flooring into toe spaces, door reveals, closets, and similar openings. Extend flooring to center of door openings.

D. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor covering as marked on substrates. Use chalk or other nonpermanent, nonstaining marking device.

3.5 FLOOR TILE INSTALLATION

A. Comply with manufacturer's written instructions for installing floor tile.

B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile width at perimeter. Install tiles square with room axis, unless otherwise indicated.

C. Adhere floor tiles to flooring using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections. Tiles shall be aligned straight with tight joints.

D. Hand roll tiles where required by tile manufacturer.

3.6 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.

C. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

D. Do not stretch resilient base during installation.

E. Job-Formed Corners: Provide job-formed corners everywhere, except as noted, as follows:
   1. Outside Corners: Use straight pieces of maximum lengths possible. Form without producing discoloration (whitening) at bends. Shave back of base at points where bends occur and remove strips perpendicular to length of base that are only deep enough to produce a snug fit without removing more than half the wall base thickness.
   2. Inside Corners: Use straight pieces of maximum lengths possible. Form by cutting an inverted V-shaped notch in toe of wall base at the point where corner is formed. Shave back of base where necessary to produce a snug fit to substrate.
   3. Adhere base to substrate with contact adhesive 12 inches each side of outside corner to properly hold base in permanent proper position in tight contact with wall. Base shall run continuous around corners with butt joints 12 inches minimum for corner.

3.7 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of resilient floorings and accessories.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

B. Perform the following operations immediately after completing flooring installation:
   1. Remove adhesive and other blemishes from exposed surfaces using cleaner recommended by resilient floor covering manufacturers.
   2. Sweep and vacuum surfaces thoroughly.
   3. Damp-mop surfaces to remove marks and soil.
      a. Do not wash surfaces until after time period recommended by manufacturer.
   4. Not more than 7 days after completion of installation, apply 1 coat of sealer/ wax to a clean, dry VCT floor covering per manufacturer's requirements, protecting surface with uniform coating and gloss. Work shall be done by a floor care subcontractor.

C. Protect flooring products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.

D. Final cleaning and buffing specified in Division 01 Section "Closeout Procedures."

E. Cover resilient flooring with undyed, untreated building paper until Substantial Completion.
   1. Do not move heavy and sharp objects directly over surfaces. Place hardboard or plywood panels over flooring and under objects while they are being moved. Slide or roll objects over panels without moving panels.

END OF SECTION 096500

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

SECTION 096800 - CARPET

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Tufted carpet.
   2. Carpet tile.
   3. Carpet cushion.
   4. Independent testing of concrete.

B. Related Sections include the following:
   1. Division 09 Section "Tile" for metal transition accessories installed with tile at tile to carpet transitions.

1.3 SUBMITTALS

A. General: Submit in accordance with Division 01 Section "Submittal Procedures."

B. Product Data: For the following, including installation recommendations for each type of substrate:
   1. Carpet and Carpet Tile: For each type indicated. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
   2. Carpet Cushion: For each type indicated. Include manufacturer's written data on physical characteristics and durability.
   3. Include installation recommendations for each type of substrate.

C. Shop Drawings: Show the following:
   1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet and carpet tile.
   2. Carpet type, color, and dye lot.
   3. Carpet tile type, color, and dye lot.
   4. Seam locations, types, and methods for carpet.
   5. Type of subfloor.
   6. Type of installation.
   7. Pattern type, repeat size, location, direction, and starting point.
   8. Pile direction.
   9. Type, color, and location of edge, transition, and other accessory strips.
   10. Transition details to other flooring materials.
   11. Type of cushion.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

D. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
   1. Carpet: 12-inch- square Sample.
   2. Carpet Tile: Full size sample.
   3. Carpet Cushion: 6-inch- square Sample.
   4. Carpet Seam: 6-inch Sample.

E. Product Schedule: For carpet, carpet tile and carpet cushion. Use same room and product designations indicated on Drawings.

F. Test Results: Provide results of specified alkalinity and adhesion tests, calcium chloride moisture tests, and relative humidity tests. Include manufacturer's written moisture requirements for each carpet type specified.

G. Adhesive Certificates: Carpet manufacturer shall certify that proposed adhesives are acceptable for use with carpet.

H. Maintenance Data: For carpet and carpet tile to include in maintenance manuals. Include the following:
   1. Methods for maintaining carpet and carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
   2. Precautions for cleaning materials and methods that could be detrimental to carpet, carpet tile and carpet cushion.

I. Warranties: Special warranties specified in this Section.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide products with the critical radiant flux classification indicated in Part 2, as determined by testing identical products per ASTM E 648 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

B. Source Limitations: Obtain each type of carpet. carpet tile and carpet cushion through a single source from a single manufacturer.

C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review specified moisture test results, alkalinity and adhesion tests, ambient conditions, ventilation procedures, installation process, adhesive application, seam sealing procedures and seam layouts. Compare results with manufacture's specified requirements for each product.

1.5 LAYOUT

A. Seam Layout: Layout differing from approved Shop Drawings that is unacceptable to the Architect and Owner shall be sufficient reason for rejection.

B. Install carpet in a manner that minimizes the number of seams that are perpendicular to traffic flow. Carpet grain and seams shall not run perpendicular to traffic flow in corridors.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1.6 DELIVERY, STORAGE, AND HANDLING

A. General: Comply with CRI's Carpet Installation Standard 2011, Section 5, "Storage and Handling."

B. Deliver materials to Project site in original factory wrappings and containers, labeled with identification of manufacturer, brand name, and lot number.

C. Store materials on-site in original undamaged packages, inside well-ventilated area protected from weather, moisture, soilage, extreme temperatures, and humidity. Lay flat, with continuous blocking off floor.

1.7 PROJECT CONDITIONS

A. General: Comply with CRI's Carpet Installation Standard 2011, Section 7, "Site Conditions - All Installations."

B. Radiant heat in floor slabs shall operate continuously for a minimum of two weeks before the testing for moisture content and adhesive bond and before the application of floor coverings.

C. Environmental Limitations: Do not install carpet, carpet tile or carpet cushion until wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at and will be continuously maintained at the levels indicated for Project when occupied for its intended use.

D. Do not install carpet, carpet tile or carpet cushion over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive, and concrete slabs have pH range recommended by carpet manufacturer.

E. Where demountable partitions or other items are indicated for installation on top of carpet or carpet tile, install carpet and carpet tile before installing these items.

1.8 WARRANTY

A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Special Warranty for Carpet and Carpet Tile: Written warranty, signed by carpet cushion manufacturer agreeing to replace carpet that does not comply with requirements or that fails within specified warranty period.
   1. Warranty does not include deterioration or failure of carpet or carpet tile due to failure of substrate, vandalism, or abuse. Warranty shall not require use of chair pads.
   2. Failures include, but are not limited to, surface wear including more than 10 percent loss of face fiber, edge raveling, snags, loss of tuft bind strength, zippering, backing resiliency loss, and delamination.
   3. Warranty Period: 15 years from date of Substantial Completion.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

PART 2 - PRODUCTS

2.1 CARPET

A. CPT-01a & CPT-01b: Shall be Lexmark Carpet Mills, Inc., Sedona, in colors indicated in Materials Legend. No seconds or imperfections shall be acceptable. Carpet shall meet the following minimum construction:

1.	Construction:	Striated cut loop.
2.	Pile Fiber and Type:	Primus Durasoft nylon.
3.	Dye Method:	Solution dyed.
4.	Face Weight:	37.0 oz./sq. yd.
5.	Pattern Repeat Width:	12 inches.
6.	Backing System:	Actionbac.
7.	Width:	12 feet.
8.	Installation:	Stretched over carpet pad.
9.	Warranty:	10 Year Wear Warranty.

B. CPT-02: Shall be Interface Inc.; Off Line, in color indicated in Materials Legend. No seconds or imperfections shall be acceptable. Carpet shall meet the following minimum construction:

1.	Construction:	Tufted textured loop.
2.	Pile Fiber and Type:	Type 6 Nylon, 100% recycled content.
3.	Dye Method:	Solution dyed.
4.	Gauge:	1/12.
5.	Stitches per Inch:	9.0.
6.	Pile Height:	0.13 inch.
7.	Pile Thickness:	0.123 inch
8.	Soil/Stain Protection:	Protekt.
9.	Backing System:	GlasBac.

2.2 CARPET TILE

A. CPT-03: Shall be Interface Inc.; Off Line, in four colors indicated in Materials Legend. No seconds or imperfections shall be acceptable. Carpet shall meet the following minimum construction:

1.	Construction:	Tufted textured loop.
2.	Pile Fiber and Type:	Type 6 Nylon, 100% recycled content.
3.	Dye Method:	Solution dyed.
4.	Gauge:	1/12.
5.	Stitches per Inch:	9.0.
6.	Pile Height:	0.13 inch.
7.	Pile Thickness:	0.123 inch
8.	Soil/Stain Protection:	Protekt.
9.	Backing System:	GlasBac.
10.	Size:	9.845 by 39.38 inches.
11.	Installation Method:	As selected by Architect.

B. CPT04: Shall be Interface, Inc., Human Nature No. HN85050, in four colors indicated in Materials Legend. No seconds or imperfections shall be acceptable. Carpet shall meet the following minimum construction:

1.	Construction:	Tufted shared.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

2.	Pile Fiber and Type:	Aquafil Type 6,6 nylon.
3.	Dye Method:	Solution dyed.
4.	Gauge:	1/10.
5.	Stitches per Inch:	7.5.
6.	Pile Height:	0.24 inch.
7.	Tufted Yarn Weight:	32.0 oz./sq. yd.
8.	Soil/Stain Protection:	Protekt.
9.	Backing System:	GlasBac RE.
10.	Installation Method:	As selected by Architect.
11.	Tile Size:	9.845 inches by 39.36 inches.
12.	Warranty:	15 years.

2.3 CARPET CUSHION

A. Polyurethane-Foam Cushion: Polyurethane precoat with high density polyurethane cushion attached to a woven scrim.
   1. Density: 15 lb/cu. ft.
   2. Product: Lexmark Carpet Mills, Inc.; Lex II EH.

2.4 INSTALLATION ACCESSORIES

A. Concrete Slab Primer: Nonstaining type provided by or recommended by carpet and carpet tile manufacturers.

B. Trowelable Leveling and Patching Compounds: Portland-cement-based formulation provided by or recommended by carpet and carpet tile cushion manufacturers.
   1. Product: Ardex; SD-F Feather Finish.

C. Connector Tabs for Carpet Tile CPT-03 and CPT-04: 3 inch adhesive squares for installing carpet tiles without glue.
   1. Product: Interface Inc.; TacTiles.

D. Tackless Carpet Stripping: Water-resistant plywood, in strips as required to match cushion thickness and that comply with CRI's Carpet Installation Standard 2011, Section 16.2.

E. Adhesive for Tackless Carpet Stripping over Gypsum Cement Underlayment over Sound Mat: Provide one of the following products:
   1. OSI Sealants; PL 400 Heavy Duty Construction Adhesive.
   2. Chemrex Corporation; CX-948 Polyurethane Adhesive/Sealant.

F. Seaming Cement: Adhesive product recommended by carpet manufacturer for sealing seams and butting cut edges at backing to form secure seams and to prevent pile loss at seams.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

conditions affecting carpet performance. Verify that substrates and conditions are satisfactory for carpet installation and comply with requirements specified.

B. Examine carpet for type, color, pattern, and potential defects.

C. For Gypsum Cement Underlayment: An independent testing agency shall verify the dryness of the underlayment using a GE Protimeter with either Surveymaster or Aquant model. A reading of 180 or less on the moisture meter indicates less than 1 percent moisture content and suitable dryness for flooring.
   1. Verify that underlayment sealer has been applied to areas receiving carpet, carpet tile and carpet cushion.
   2. Areas where sealer has worn off shall be recoated under Division 03 Section "Gypsum Cement Underlayment" not less than 2 hours prior to application of adhesives.

D. If conditions detrimental to work are encountered, prepare written report, signed by Installer, documenting unsatisfactory conditions and send to the Architect.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with CRI's Carpet Installation Standard 2011, Section 7, "Site Conditions - All Installations," and with carpet, carpet tile and carpet cushion manufacturers's written installation instructions for preparing.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider, unless more stringent requirements are required by manufacturer's written instructions.

C. Level subfloor within 1/4 inch in 10 feet, noncumulative, in all directions using product recommended by manufacturer. Sand or grind protrusions, bumps, and ridges.
   1. Use leveling and patching compounds to fill cracks, holes, and depressions in subfloor as recommended by carpet, carpet tile and carpet cushion manufacturers.

D. Remove coatings, including curing compounds, paint, joint compound, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet, carpet tile and cushion manufacturers.

E. Broom and vacuum clean substrates to be covered immediately before installing carpet, carpet tile and carpet cushion. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 CARPET INSTALLATION

A. Comply with CRI's Carpet Installation Standard 2011 and carpet manufacturer's written installation instructions for the following:
   1. Stretch-in Installation: Comply with CRI 2011, Section 16, "Stretch-in Installation."

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

B. Installation of Tackless Strips over Gypsum Cement Underlayment over Sound Mat: Use adhesive installation only. Adhere tackless strips to underlayment in accordance with adhesive manufacturer's written instructions. Do not install carpet until adhesive has cured according to adhesive manufacturer's instructions.

C. Comply with carpet cushion manufacturer's written recommendations. Install carpet cushion seams at 90-degree angle with carpet seams.

D. Comply with carpet manufacturer's written recommendations and Shop Drawings for seam locations and direction of carpet; maintain uniformity of carpet direction and lay of pile. At doorways, center seams under the door in closed position.

E. Cut and fit carpet to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet manufacturer.

F. Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.

H. Install pattern parallel to walls and borders to comply with CRI 2011, Section 19, "Patterned Carpet Installations" and with carpet manufacturer's written recommendations, except as indicated otherwise.

I. Seal seams with continuous bead of seam sealer. Roll completed seams.

3.4 CARPET TILE INSTALLATION

A. Comply with CRI's Carpet Installation Standard 2011, Section 19, "Carpet Modules," and with carpet tile manufacturer's written installation instructions.
   1. Confirm installation method (herringbone or ashlar) with Architect prior to commencement of installation.

B. Installation Method for CPT-03 & CPT-04: Install with connector tabs in accordance with manufacturer's written installation instructions.

C. Maintain dye lot integrity. Do not mix dye lots in same area.

D. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.

E. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.

G. Install pattern parallel to walls.

3.5 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet and carpet tile:
   1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet and carpet tile manufacturer.
   2. Remove yarns that protrude from carpet and carpet tile surface.
   3. Vacuum carpet and carpet tile using commercial machine with face-beater element.

B. Protect installed carpet and carpet tile to comply with CRI's Carpet Installation Standard 2011, Section 20, "Protection of Indoor Installations."

C. Protect carpet and carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet, carpet tile, carpet cushion and carpet adhesive manufacturers to ensure carpet and carpet tile are without damage or deterioration at the time of Substantial Completion.

END OF SECTION 096800

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

SECTION 099000 - PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Exposed exterior items and surfaces with low VOC coatings complying with ME DEP regulations (OTC regulations).
   2. Exposed interior items and surfaces with low VOC coatings complying with ME DEP regulations (OTC regulations).
   3. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.

B. Related Sections include the following:
   1. Division 05 Section "Metal Fabrications" for shop priming ferrous metal.
   2. Division 06 Section "Finish Carpentry" for surface preparation of exterior and interior finish carpentry.
   3. Division 06 Section "Architectural Woodwork" for surface preparation of custom interior standing and running trim and shop finishing of architectural casework.
   4. Division 07 Section "Fiber-Cement Siding" for factory-applied primer and first finish coat on siding.
   5. Division 08 Section "Hollow Metal Doors and Frames" for factory priming steel doors and frames.
   6. Division 08 Section "Wood Doors" for factory priming wood door frames with an opaque finish.
   7. Division 09 Section "Gypsum Board Assemblies" for surface preparation of gypsum board.
   8. Review all sections for shop primed items requiring field painting.

1.3 DEFINITIONS

A. General: Standard coating terms defined in ASTM D 16 apply to this Section.
   1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.
   2. Eggshell refers to low-sheen finish with a gloss range between 20 and 35 when measured at a 60-degree meter.
   3. Satin refers to low-sheen finish with a gloss range between 15 and 35 when measured at a 60-degree meter.
   4. Semigloss refers to medium-sheen finish with a gloss range between 35 and 70 when measured at a 60-degree meter.
   5. Full gloss refers to high-sheen finish with a gloss range more than 70 when measured at a 60-degree meter.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1.4 SUBMITTALS

A. General: Submit in accordance with Division 01 Section "Submittal Procedures."

B. Product Data: For each paint system indicated. Include block fillers and primers.
1. Material List: An inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
2. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material proposed for use.
3. Include printed statement of VOC content for each product.

C. Schedule: Provide schedule of all surfaces to be coated, with prime and finish coat material listed, and manufacturer's recommended wet film thickness.

D. Qualification Data: For Applicator.

1.5 QUALITY ASSURANCE

A. Applicator Qualifications: Engage an experienced Applicator who has completed painting system applications similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

B. Source Limitations: Obtain primers and undercoat materials for each coating system from the same manufacturer as the finish coats.

C. Benchmark Samples (Mockups): Provide a full-coat benchmark finish sample for each type of coating and substrate required. Duplicate finish of approved sample Submittals.
1. Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
2. Architect will select one room or surface to represent surfaces and conditions for each type of coating and substrate to be painted.
   a. Wall Surfaces: Provide samples of at least 100 sq. ft.
   b. Small Areas and Items: Architect will designate items or areas required.
3. After permanent lighting and other environmental services have been activated, apply benchmark samples, according to requirements for the completed Work. Provide required sheen, color, and texture on each surface.
   a. After finishes are accepted, Architect will use the room or surface to evaluate coating systems of a similar nature.
4. Final approval of colors will be from benchmark samples.
5. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the Project Site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label, and the following information:
1. Product name or title of material.
2. Product description (generic classification or binder type).
3. Manufacturer's stock number and date of manufacture.
4. Contents by volume, for pigment and vehicle constituents.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

5. Thinning instructions.
6. Application instructions.
7. Color name and number.
8. VOC content.

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F. Maintain containers used in storage in a clean condition, free of foreign materials and residue.
   1. Protect from freezing. Keep storage area neat and orderly.
   2. Remove oily rags and waste daily.
   3. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

1.7 PROJECT CONDITIONS

A. Apply paints only when temperatures of surfaces to be painted and surrounding air are between 45 and 95 deg F.

B. Do not apply paint in snow, rain, fog, or mist; or when relative humidity exceeds 85 percent; or at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.
   1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.
   2. Allow wet surfaces to dry thoroughly and attain temperature and conditions specified before proceeding with or continuing coating operation.

1.8 EXTRA MATERIALS

A. Furnish extra paint materials from the same production run as the materials applied and in the quantities described below. Package with protective covering for storage and identify with labels describing contents. Deliver extra materials to Owner.
   1. Quantity: Furnish Owner with not less than 1 gal., of each material and color applied for Owner's use during move in.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.

B. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
   1. Benjamin Moore & Company (Moore).
   2. PPG Architectural Finishes, Inc. (PPG).
   3. Sherwin-Williams Co. (S-W).
   4. Flame Control Coatings, LLC (Flame Control); phone: (716) 282-1399; available through Sherwin-Williams.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

2.2 COATINGS MATERIALS, GENERAL

A. Material Compatibility: Provide block fillers, primers, undercoats, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

B. Material Quality: Provide manufacturer's best quality coating material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated. Paint-material containers not displaying manufacturer's product identification will not be acceptable.
   1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers listed in the specification schedule. Furnish manufacturer's material data and certificates of performance for proposed substitutions.
   2. Where schedule says no substitution, use proprietary product only. Do not propose substitution, as the products from the other manufacturers have been considered, and are not acceptable.

C. VOC Compliance for Exterior and Interior Paints and Coatings: Provide the manufacturer's formulation for the products specified below that are VOC compliant with the State of Maine Department of Environmental Protection Regulations and the following chemical restrictions from the Ozone Transport Commission (OTC) expressed in grams per liter:
   1. Flat Paints and Coatings: VOC content of not more than 100 g/L.
   2. Non-Flat Paints and Coatings: VOC content of not more than 150 g/L.
   3. Anticorrosive (Rust Preventative) Coatings: VOC content of not more than 400 g/L.
   4. Clear Wood Coatings:
      a. Sanding Sealers (Other than Lacquer Sanding Sealers): VOC content of not more than 350 g/L.
      b. Varnishes: VOC content of not more than 350 g/L.
   5. Fire Retardant Coatings:
      a. Opaque: VOC content of not more than 350 g/L.
   6. Industrial Maintenance Coatings (IMC): VOC content of not more than 340 g/L.
   7. Primers, Sealers, and Undercoaters: VOC content of not more than 200 g/L.
   8. Quick-Dry Enamels: VOC content of not more than 250 g/L.
   9. Quick-Dry Primers, Sealers, and Undercoaters: VOC content of not more than 200 g/L.
   10. Specialty Primers, Sealers, and Undercoaters: VOC content of not more than 350 g/L.
   11. Stains: VOC content of not more than 500 g/L.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator and drywall subcontractor present, under which painting will be performed for compliance with paint application requirements.
   1. Inspect walls for dents and imperfections prior to painting. Inspect walls again after primer and first coat of paint applied, with Applicator and drywall subcontractor present. Drywall subcontractor shall touch-up as follows:
      a. Touch-up visible gypsum board imperfections before priming of walls.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

b. Touch-up imperfections found in field of boards and joints made visible from painting after first finish coat applied.

2. If unacceptable conditions are encountered, prepare written report, endorsed by Applicator, listing conditions detrimental to performance of work.
3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
4. Application of coating indicates Applicator's acceptance of surfaces and conditions within a particular area.
5. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.

B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of specified finish materials to ensure use of compatible primers.
1. Notify Architect about anticipated problems when using the materials specified over substrates primed by others.

3.2 PREPARATION

A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of size or weight of the item, provide surface-applied protection before surface preparation and painting.
1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

B. Cleaning: Before applying paint or other surface treatments, clean substrates of substances that could impair bond of the various coatings. Remove oil and grease before cleaning.
1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.
1. Provide barrier coats over incompatible primers or remove and reprime.
2. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.
   a. Sand exposed wood framing members to remove exposed grade stamps.
   b. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer before applying primer.
   c. Prime, stain, or seal wood to be painted immediately on delivery. Prime edges, ends, faces, undersides, and back sides of wood.
   d. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.
3. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC's standards.
   a. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.

62 India St
Portland, M
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Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

b. Touch up bare areas and shop-applied prime coats that have been damaged. Clean with solvents recommended by paint manufacturer and SSPC SP2; and touch up with same primer as the shop coat.

4. Galvanized Surfaces: Uniformly abrade galvanized surfaces with a palm sander and 60 grit aluminum oxide so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
   a. Clean field welds with nonpetroleum-based solvents complying with SSPC's standards so surface is free of oil and surface contaminants.
5. Metal Doors and Frames: Wipe down to remove oils and surface contaminates during shipping and installation.

D. Material Preparation: Mix and prepare paint materials according to manufacturer's written instructions.
   1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
   2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
   3. Use only thinners approved by paint manufacturer and only within recommended limits.

3.3 APPLICATION

A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.
   1. Paint colors, surface treatments, and finishes are indicated in the paint schedules.
   2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
   3. Provide finish coats that are compatible with primers used.
   4. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, grilles, convector covers, covers for finned-tube radiation, and similar components are in place. Extend coatings in these areas, as required, to maintain system integrity and provide desired protection.
   5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
   6. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
   7. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
   8. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.
   9. Sand lightly between each succeeding enamel or varnish coat.

B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
   1. The number of coats and film thickness required are the same regardless of application method. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

2. Omit primer over metal surfaces that have been shop primed and touchup painted, unless otherwise indicated.
3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure that edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, and does not deform or feel sticky under moderate thumb pressure, and until application of another coat of paint does not cause undercoat to lift or lose adhesion.

C. Paint all exposed surfaces, except where the paint schedules indicate that a surface or material is not to be painted or is to remain natural. If the paint schedules do not specifically mention an item or a surface, paint the item or surface the same as similar adjacent materials or surfaces whether or not schedules indicate colors. If the schedules do not indicate color or finish, the Architect will select from standard colors and finishes available.
1. Painting includes field painting of exposed bare and covered pipes and ducts (including color-coding), hangers, exposed steel and iron work, and primed metal surfaces of mechanical and electrical equipment at all locations, except mechanical and electrical rooms.

D. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.
1. Labels: Do not paint over Underwriters Laboratories (UL), Factory Mutual (FM), or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

E. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions. Walls shall have roller finish.
1. Brushes: Use brushes best suited for type of material applied. Use brush of appropriate size for surface or item being painted.
2. Rollers: Use rollers of carpet, velvet-back, or high-pile sheep's wool as recommended by manufacturer for material and texture required.
3. Spray Equipment: Use airless spray equipment with orifice size as recommended by manufacturer for material and texture required.
    a. Grilles shall be spray painted.

F. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate to achieve dry film thickness indicated. Provide total dry film thickness of the entire system as recommended by manufacturer.

G. Mechanical and Electrical Work: Painting of mechanical, plumbing, fire protection, and electrical work is limited to items exposed in occupied spaces (outside mechanical and electrical rooms).

H. Mechanical, plumbing, and fire protection items to be painted include, but are not limited to, the following:
1. Piping, pipe hangers and supports.
2. Insulation.
3. Accessory items.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

I. Electrical items to be painted include, but are not limited to, the following:
   1. Conduit and fittings.
   2. Panel boards.

J. Prime Coats: Before applying finish coats, apply a prime coat, as recommended by manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn-through or other defects due to insufficient sealing.

K. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

L. Transparent (Clear or Stained) Finishes: Use multiple coats to produce a glass-smooth surface film of even luster. Provide a finish free of laps, runs, cloudiness, color irregularity, brush marks, orange peel, nail holes, or other surface imperfections.
   1. Provide satin finish for final coats, unless otherwise noted.

M. Stipple Enamel Finish: Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling, such as laps, irregularity in texture, skid marks, or other surface imperfections.

N. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

O. Exterior Ferrous Metal Items to Be Painted Include, but Are Not Limited To, the Following:
   1. Exposed structural steel and lintel plates.
      a. Galvanized single angle lintels do not require painting, except as noted otherwise.
   2. Steel doors and frames.
   3. Bollards.
   4. Metal fabrications; see Division 05 Section "Metal Fabrications."
   5. Miscellaneous metal items, including galvanized steel.

P. Interior Ferrous Metal Items to Be Painted Include, but Are Not Limited To, the Following:
   1. Steel doors and frames.
   2. Handrails and guardrails.
   3. Access panels (both sides).
   4. Metal fabrications; see Division 05 Section "Metal Fabrications."
   5. Miscellaneous metal items.

3.4 CLEANING

A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from the Project site.
   1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping. Be careful not to scratch or damage adjacent finished surfaces.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

3.5 PROTECTION

A. Protect work of other trades, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.

B. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.
   1. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 EXTERIOR PAINT SCHEDULE

A. VOC Compliance, General: Provide the manufacturers' formulations for the products specified below that comply with the VOC requirements for the State of Maine Department of Environmental Protection in paragraph 2.2.C of this Section.

B. Fiber-Cement Siding and Trim: Provide the following finish systems over exterior fiber-cement substrates:
   1. Low-Luster Acrylic Finish: 2 finish top coats over factory primer .
      a. Sealer/Primer: Factory applied.
      b. Topcoats: Low-luster (satin), exterior, acrylic-latex coating applied at spreading rate recommended by the manufacturer to achieve a dry film thickness of not less than indicated for product. Apply one coat of finish on flashing materials before they are installed, and topcoat with siding topcoat applications. Touch up all surface fasteners with one coat of finish before application of topcoat.
         1) Moore: Ben 100% Acrylic Exterior Low Lustre Finish No. 542; 2.6 mils DFT.
         2) PPG: Speedhide 6-2045 Exterior Satin 100% Acrylic Latex; 1.0 mils DFT.
         3) S-W: Duration Exterior Acrylic Satin K33-200 Series; 2.5 mils DFT.

C. Ferrous Metal: Provide the following finish systems over exterior ferrous metal. Primer is not required on shop-primed items, except steel doors and frames, which require a primer under this specification.
   1. Semigloss, Waterborne Alkyd Finish: 2 finish coats over a corrosion resistant primer.
      a. Primer: Quick-drying, corrosion resistant, water borne alkyd metal primer applied at spreading rate recommended by the manufacturer to achieve a dry film thickness of not less than indicated for product. Moore and S-W do not have exterior products meeting requirements.
         1) PPG: Speedhide 6-208 Interior/Exterior Rust Inhibitive Steel Primer; 2.3 mils DFT.
      b. First and Second Coats: Semigloss, exterior, water borne alkyd finish applied at spreading rate recommended by the manufacturer to achieve a dry film thickness per coat of not less than indicated for product. Moore and S-W do not have exterior products meeting requirements.
         1) PPG: Speedhide 6-1510 Series Interior/Exterior WB Alkyd Semi-Gloss; 1.5 mils DFT per coat.

D. Zinc-Coated Metal: Provide the following finish systems over exterior zinc-coated (galvanized) metal surfaces: Primer is not required on shop-primed items, except zinc-coated (galvanized) steel doors and frames, which require a primer under this specification.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1. Semigloss, Water Borne Alkyd Finish: 2 finish coats over a primer.
   a. Primer: Quick-drying, corrosion resistant, water borne alkyd metal primer applied at spreading rate recommended by the manufacturer to achieve a dry film thickness of not less than indicated for product. Moore and S-W do not have exterior products meeting requirements.
      1) PPG: Speedhide 6-209 Interior/Exterior Galvanized Steel Primer; 1.8 mils DFT.
   b. First and Second Coats: Semigloss, exterior, water borne alkyd finish applied at spreading rate recommended by the manufacturer to achieve a dry film thickness per coat of not less than indicated for product. Moore and S-W do not have exterior products meeting requirements.
      1) PPG: Speedhide 6-1510 Series Interior/Exterior WB Alkyd Semi-Gloss; 3.0 mils DFT.

3.7 LOW VOC INTERIOR COATINGS

A. VOC Compliance, General: Provide the manufacturers' formulations for the products specified below that comply with the VOC requirements for the State of Maine Department of Environmental Protection in as defined in paragraph 2.2.C of this Section.

B. Gypsum Board: Provide the following finish systems over interior gypsum board:
   1. Flat Acrylic Finish, GPDW Soffits and Ceilings: 2 finish coats over a primer.
      a. Primer: Low-odor, low VOC, latex-based, interior primer applied at spreading rate recommended by the manufacturer to achieve a dry film thickness of not less than indicated for product.
         1) Moore: Ben Premium Interior Latex Primer No. W624; 1.2 mils DFT.
         2) PPG: Speedhide Interior MaxPrime Latex Primer/Surfacer 6-4; 1.0 mils DFT.
         3) S-W: ProMar 200 Interior Latex Primer, B28W08200 Series; 1.1 mils DFT.
      b. First and Second Coats: Low-odor, low VOC, flat, acrylic-latex-based, interior paint applied at spreading rate recommended by the manufacturer to achieve a dry film thickness per coat of not less than indicated for product.
         1) Moore: Ben Premium Interior Latex Flat No. W625; 1.2 mils DFT per coat.
         2) PPG: Speedhide Interior Latex Flat 6-70 Series; 1.3 mils DFT per coat.
         3) S-W: ProMar 200 Interior Latex Flat, B30W200 Series; 2.6 mils DFT per coat.
   2. Low-Luster (Satin or Eggshell), Acrylic-Latex Finish, Walls: 2 finish coats over a primer.
      a. Primer: Low odor, low VOC, latex-based, interior primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than indicated for product.
         1) Moore: Ben Premium Interior Latex Primer No. W624; 1.2 mils DFT.
         2) PPG: Speedhide Interior MaxPrime Latex Primer/Surfacer 6-4; 1.0 mils DFT.
         3) S-W: ProMar 200 Interior Latex Flat, B30W200 Series; 1.5 mils DFT.
      b. First and Second Coats: Low odor, low VOC, low-luster (eggshell or satin), acrylic-latex, interior finish applied at spreading rate recommended by the

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

manufacturer to achieve a dry film thickness per coat of not less than indicated for product.

1) Moore: Ben Premium Interior Latex Eggshell No. W626; 1.3 mils DFT per coat.
2) PPG: Speedhide Interior Satin Acrylic Latex ; 1.4 mils DFT per coat.
3) S-W: ProMar 200 Interior Latex Eg-Shel, B20W2200 Series; 1.6 mils DFT per coat.

C. Stained Woodwork and Trim: Provide the following stained finishes over new, interior woodwork and trim:

1. Waterborne, Satin Polyurethane Finish: 3 finish coats of a waterborne, clear-satin polyurethane over a stain coat.
   a. Stain Coat: VOC compliant, penetrating, interior wood stain applied at spreading rate recommended by the manufacturer. Stain color as selected by Architect from the manufacturer's full range of options to match finish applied to flush wood doors.
      1) Moore: Benwood Interior Wood Finishes Waterborne Stain No. 205.
      2) PPG: Olympic 44500 Premium Interior Oil Based Wood Stain.
      3) S-W: Minwax Wood Finish VOC Formula.

   b. First, Second and Third Finish Coats: Waterborne, polyurethane finish applied at spreading rate recommended by the manufacturer.
      1) Moore: Benwood Stays Clear Acrylic Polyurethane Low Lustre No. 423.
      2) PPG: Olympic 42786 Premium Interior Water Based Polyurethane Satin Clear.
      3) S-W: Minwax Polycrylic.

D. Wood Trim and Door Frames, Opaque Finish: Provide the following paint finish systems over new, interior wood surfaces:

1. Semigloss, Acrylic-Enamel Finish, Trim and Door Frames: 2 finish coats over a wood undercoater/primer.
   a. Primer: Low VOC, stain-blocking, acrylic-latex-based, interior wood undercoater, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a dry film thickness of not less than indicated for product.
      1) Moore: Fresh Start High-Hiding All-Purpose Primer No. 056; 1.4 mils DFT.
      2) PPG: Speedhide 6-2 Interior Latex Sealer Quick-Drying; 1.0 mils DFT.
      3) S-W: Premium Wall & Wood Primer B28W08111 Series; 1.8 mils DFT.
   b. First and Second Coats: Low odor, low VOC, semigloss, acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a dry film thickness per coat of not less than indicated for product.
      1) Moore: Ben Premium Interior Latex Semi-Gloss No. W627; 1.5 mils DFT per coat.
      2) PPG: Speedhide Interior High Lustre Semi-Gloss Latex, 6-8510 Series; 1.2 mils DFT per coat.
      3) S-W: ProGreen 200 Low VOC Interior Latex Semi-Gloss B31W2200 Series; 1.6 mils DFT per coat.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

E. Ferrous Metal: Provide the following finish systems over ferrous metal. Primer is not required on shop-primed items, except steel doors and frames, which require a primer under this specification. Prime bare spots and cracks on ferrous metals.
   1. Semigloss, Water Based Alkyd Finish: 2 finish coats over a primer.
      a. Primer: Quick-drying, corrosion resistant, water borne alkyd primer or self cross-linking acrylic primer, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a dry film thickness of not less than indicated for product.
         1) Moore: Advance Waterborne Interior Alkyd Primer No. 790; 1.6 mils DFT.
         2) PPG: Speedhide 6-208 Interior/Exterior Rust Inhibitve Steel Primer; 2.3 mils DFT.
         3) S-W: Pro Industrial Pro-Cryl Universal Primer B66-310 Series; 3.0 mils DFT.
      b. First and Second Coats: Low VOC, semigloss, interior water borne alkyd finish applied at spreading rate recommended by the manufacturer to achieve a dry film thickness per coat of not less than indicated for product.
         1) Moore: Advance Waterborne Interior Alkyd Gloss No. 794; 1.6 mils DFT per coat.
         2) PPG: Speedhide 6-1510 Series Interior/Exterior WB Alkyd Semi-Gloss; 1.5 mils DFT per coat.
         3) S-W: ProMar 200 Interior Waterbased Acrylic-Alkyd Semi-Gloss, B34-8200 Series; 1.7 mils DFT per coat.

F. Telecommunication, Data and Electrical Backboards: Provide the following finish over plywood:
   1. Flat Intumescent Finish: Two finish coats over a primer.
      a. Primer: Latex-based, interior primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than indicated for product.
         1) Moore: Fresh Start High-Hiding All-Purpose Primer No. 056; 1.4 mils DFT.
         2) SW: Preprite Problock Interior/Exterior Latex Primer\Sealer; 1.4 mils DFT.
      b. First and Second Coats: Intumescent-type, fire-retardant paint applied at spreading rate recommended by manufacturer to achieve a total dry film thickness of not less than 4 mils; white color for telecommunication and black for electrical.
         1) Moore: P59 220 Latex Fire-Retardant Coating.
         2) FlameControl: 20-20A Flat Latex Intumescent Coating.

G. Fire-Rated Partition Identification: Identify all smoke partitions and all fire-rated walls and partitions by stenciling "X-HOUR FIRE WALL", where "X" is the hourly rating; provide on each side of rated walls above ceiling line with 4 inch high letters in red or orange semigloss paint; each rated wall shall be identified with fire rating of wall at least once and at a spacing not greater than 12 feet o.c. and not more than 5 feet from each end of the wall.
   1. First Coat: Low odor, low VOC, semigloss, acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than indicated for product.
      a. Moore: Ben Premium Interior Latex Semi-Gloss No. W627; 1.5 mils DFT.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

b. PPG: Speedhide Interior High Lustre Semi-Gloss Latex, 6-8510 Series; 1.2 mils DFT per coat.

c. S-W: ProGreen 200 Interior Latex Semi-Gloss B31W2200 Series; 1.5 mils DFT.

END OF SECTION 099000

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

SECTION 102800 - TOILET AND BATH ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes toilet and bath accessories. Extent of each type is indicated on Drawings and schedules. Type of toilet and bath accessories includes, but is not limited to, the following:
   1. Toilet tissue holder.
   2. Towel rods.
   3. Towel rings.
   4. Robe hooks.

B. Related Sections include the following:
   1. Division 06 Section "Rough Carpentry" for concealed wood blocking to support accessories.

1.3 SUBMITTALS

A. General: Submit in accordance with Division 01 Section "Submittal Procedures."

B. Product Data: Include construction details, material descriptions and thicknesses, dimensions, profiles, fastening and mounting methods, specified options, and finishes for each type of accessory specified.

C. Shop Drawings: Include blocking locations and mounting heights identified.

D. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required. Use room designations indicated on Drawings.

E. Maintenance Data: For accessories to include in maintenance manuals specified in Division 01. Provide lists of replacement parts and service recommendations.

PART 2 - PRODUCTS

2.1 TOILET AND BATH ACCESSORIES

A. Toilet and Bath Accessories: Provide the following items from the Electra Series by Taymor Industries, Ltd. with a US26, polished chrome finish:
   1. Toilet Tissue Holder: Electra Model 04-2148.
   2. Towel Bars: Electra Model 04-21 Series; lengths as indicated.
   3. Towel Ring: Electra Model 04-2104.
   4. Robe Hook: Electra Model 04-2101.

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

2.2 FABRICATION

A. General: Names or labels are not permitted on exposed faces of accessories. On interior surface not exposed to view or on back surface of each accessory, provide printed, waterproof label or stamped nameplate indicating manufacturer's name and product model number.

B. Sections and shapes shall be rolled, formed, drawn, or extruded as required for respective functions.

C. Fastenings, exposed metal fastenings, and accessories, unless Underwriters prohibit for safety, shall be of same materials, texture, color and finish as the base metal to which applied.

D. Surface-Mounted Toilet Accessories: Unless otherwise indicated, fabricate units with tight seams and joints. Provide concealed anchorage where possible.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Grab bars shall be screwed to solid blocking in stud partitions. Install grab bars to withstand a downward load of at least 250 lbf, when tested according to method in ASTM F 446.

C. Concealed Blocking: Provided in Division 06 Section "Rough Carpentry."

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation and verify that mechanisms function properly. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION 102800

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

SECTION 103100 - MANUFACTURED FIREPLACES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Manufactured gas fireplaces.
   2. Venting system.

B. Related Sections include the following:
   1. Division 23 Sections for gas piping and venting of units.
   2. Division 26 Sections for electrical service and connections.

1.3 SUBMITTALS

A. General: Submit in accordance with Division 01 Section "Submittal Procedures."

B. Product Data: For each type of product indicated. Include manufacturer's installation instructions.

C. Shop Drawings: Show layout, elevations, sections, roughing-in dimensions, clearance requirements, fabrication details, utility service requirements, and attachments to other work.

D. Operation and Maintenance Data: Submit manufacturer's printed instructions for cleaning and maintaining manufactured fireplaces to include in operation, and maintenance manuals specified in Division 01 Section "Operation and Maintenance Data."

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of manufactured fireplace through one source from a single manufacturer.

B. Safety Glass: Category I and II materials complying with testing requirements in 16 CFR 1201 and in ANSI Z97.1.

C. UL Certification: Provide electric and fuel-burning components that are evaluated, certified and labeled by UL to comply with ANSI Z21.50.

D. Regulatory Requirements: Fabricate and label prefabricated fireplaces to comply with provisions of the following:
   1. NFPA 54, "National Fuel Gas Code."
   2. NFPA 70, "National Electrical Code."

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver prefabricated fireplaces and accessories to site in manufacturer's sealed, undamaged shipping containers. Inspect products upon receipt to ensure products are free from damage occurring in transit.

B. Store products in covered area, above ground, and protected from inclement weather and humidity. Avoid using nonvented plastic or canvas shelters that could create a humidity chamber.

PART 2 - PRODUCTS

2.1 GAS FIREPLACE UNITS

A. General: Provide top vented, fireplace units with safety pilot, ignitor, and specified accessories complying with the listed Drawings.

B. Single-Sided Fireplace: Provide single side unit with fixed glass panel, direct vent unit having the following characteristics:
   1. Type: Direct vent gas unit with sealed combustion chamber.
   2. Unit Framing Dimensions: 37inches wide, 34-3/8 inches high and 16-5/16 inches deep.
   3. Rating: 12,000 BTU to 17,500 BTU/hr input.
   4. Valve: Provide with variable valve allowing for the adjustment of flame height and heat output. IntelliFire Ignition System.
   5. Controls: RCT-MLT-HNG Hand held remote transmitter control operation and WSK-MLT wall control.
   6. Vent System: Venting components, including elbows, flue restrictors, pipe supports, flashing and terminations.
      a. At flat roof, provide high wind vertical termination with water tight curb cap roof flashing.
      b. At wall, provide horizontal high performance termination cap.
   7. Product: Heat-N-Glo ModelSL-550F, Slimline Fusion.

C. Blower Unit: 160 cfm unit; provide for each unit.

D. Ceramic fiber stones.

E. Trim Kit:
   1. Clean Face Front for each unit; Stainless steel finish trim kit.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of manufactured fireplace.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

3.2 INSTALLATION

A. Install manufactured fireplace units in strict accordance with manufacturer's written instructions and with requirements of authorities having jurisdiction.
   1. Seal vent pipe section joints with high temperature rated sealant.
   2. Support horizontal and vertical vent runs with manufacturer’s vent supports. Vent pipe shall be secured to
   3. Extend vertical discharge opening above roof surface 3 feet.
   4. Fasten roof flashing roof blocking in a manner that will prevent movement by wind loading. Coordinate with roof membrane and membrane flashing installation.

3.3 ADJUSTING AND CLEANING

A. Adjust components for proper operation.

B. Clean exposed surfaces in accordance with manufacturer's instructions.

END OF SECTION 103100

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

SECTION 104400 - FIRE-PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Portable fire extinguishers.
   2. Fire-protection cabinets for portable fire extinguishers.
   3. Mounting brackets for fire extinguishers.

B. Related Sections include the following:
   1. Division 07 Section "Through-Penetration Firestop Systems" for firestopping sealants at fire-rated cabinets.
   2. Division 09 painting Sections for field painting fire-protection cabinets.

1.3 SUBMITTALS

A. General: Submit in accordance with Division 01 Section "Submittal Procedures."

B. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire-protection cabinets.
   1. Fire Extinguishers: Include rating and classification.
   2. Fire-Protection Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.

C. Maintenance Data: For fire extinguishers and fire-protection cabinets to include in maintenance manuals.

D. Warranty: Sample of special warranty.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain fire extinguishers and fire-protection cabinets through one source from a single manufacturer.

B. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

C. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
   1. Provide fire extinguishers approved, listed, and labeled by FMG.

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

D. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements of ASTM E 814 for fire-resistance rating of walls where they are installed.

E. Fire Extinguisher Inspection: Prior to installation, professionally inspect all fire extinguishers in accordance with NFPA 10, "Portable Fire Extinguishers" and attach tag to the fire extinguisher verifying inspection and inspection date. Tag shall comply with the requirements of the local authority having jurisdiction. Tag with manufacturing date only is not acceptable.

1.5 COORDINATION

A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

B. Coordinate sizes and locations of fire protection cabinets with wall depths.

1.6 SEQUENCING

A. Apply vinyl lettering on field-painted fire-protection cabinets after painting is complete.

1.7 WARRANTY

A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Special Warranty for Fire Extinguishers: Manufacturer's standard form in which manufacturer agrees to repair or replace components of portable fire extinguishers that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Failure of hydrostatic test according to NFPA 10.
      b. Faulty operation of valves or release levers.
   2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers:
   1. JL Industries, Inc.
   2. Larsen's Manufacturing Company.
   3. Potter Roemer; Div. of Smith Industries, Inc.

B. Fire extinguisher cabinets, fire extinguishers, and mounting brackets shall be from same manufacturer.

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

B. Aluminum: Alloy and temper recommended by aluminum producer and manufacturer for type of use and finish indicated, and as follows:
   1. Sheet: ASTM B 209.
   2. Extruded Shapes: ASTM B 221.

C. Tempered Float Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear).

2.3 PORTABLE FIRE EXTINGUISHERS

A. General: Provide fire extinguishers of type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.
   1. Handles and Levers: Manufacturer's standard.
   2. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B.

B. Multipurpose Dry-Chemical Type in Steel Container: UL-rated , with monoammonium phosphate-based dry chemical in enameled-steel container in the following nominal capacities:
   1. Provide 2-A:10-B:C, 5-lb units for all fire extinguisher cabinets.
   2. Provide4-A:80-B:C, 10-lb bracket mounted units in all mechanical rooms, and where indicated.

2.4 FIRE-PROTECTION CABINET

A. Products:
   1. JL Industries, Inc.; Ambassador Series.
   2. Larsen's Manufacturing Company; Architectural Series.
   3. Potter Roemer; Div. of Smith Industries, Inc.; Alta Series.

B. Cabinet Type: Suitable for fire extinguisher.

C. Cabinet Construction: Nonrated and rated; rated units as required for wall construction where cabinet is located.

D. Cabinet Material: Enameled-steel sheet.
   1. Shelf: Same metal and finish as cabinet.

E. Semirecessed Cabinet: Cabinet box partially recessed in walls of shallow depth to suit style of trim indicated; with one-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
   1. Rolled-Edge Trim: 2-1/2-inch backbend depth.

F. Cabinet Trim Material: Steel sheet.

G. Door Material: Steel sheet.

H. Door Style: Vertical duo panel with frame.

I. Door Glazing: Tempered float glass (clear).

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

J. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
   1. Provide manufacturer's standard.
   2. Provide continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.

K. Accessories:
   1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
   2. Door Lock: Cam lock that allows door to be opened during emergency by pulling sharply on door handle.
   3. Identification: Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER"; pressure sensitive vinyl lettering complying with authorities having jurisdiction for letter style, size, spacing, and location; lettering orientation and color as selected by Architect. Locate as indicated by Architect.

L. Finishes:
   1. Manufacturer's standard baked-enamel paint for the interior of cabinet.
   2. Steel: Factory primed for field painting for the exterior of cabinet and cabinet door.

2.5 MOUNTING BRACKETS

A. Mounting Brackets: Manufacturer's standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with black baked-enamel finish.

B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
   1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface; vertical orientation.

2.6 FABRICATION

A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub), with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
   1. Weld joints and grind smooth.
   2. Construct fire-rated cabinets with double walls fabricated from 0.0428-inch- thick, cold-rolled steel sheet lined with minimum 5/8-inch- thick, fire-barrier material. Provide factory-drilled mounting holes.

B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.
   1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
   2. Miter and weld perimeter door frames.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

2.7 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Finish fire-protection cabinets after assembly.

D. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.8 STEEL FINISHES

A. Surface Preparation: Clean surfaces of dirt, oil, grease, mill scale, rust, and other contaminants that could impair paint bond using manufacturer's standard methods.

B. Factory Priming of Cabinet Exteriors for Field-Painted Finish: Apply shop primer specified below immediately after surface preparation and pretreatment.
1. Shop Primer: Manufacturer's or fabricator's standard, fast-curing, lead- and chromate-free, universal primer, selected for resistance to normal atmospheric corrosion, for compatibility with substrate and field-applied finish paint system indicated, and for capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.

C. Baked-Enamel Finish for Fire Extinguishers and Interior of Cabinets: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-enamel finish consisting of prime coat and thermosetting topcoat. Comply with paint manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where semirecessed cabinets will be installed.

B. Examine fire extinguishers for proper charging and tagging.
1. Remove and replace damaged, defective, or undercharged units.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare recesses for semirecessed fire-protection cabinets as required by type and size of cabinet and trim style.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

3.3 INSTALLATION

A. General: Install fire-protection specialties in locations and at mounting heights indicated or, if not indicated, at heights indicated below:
   1. Fire-Protection Cabinets: 54 inches above finished floor to top of cabinet.
   2. Mounting Brackets: 54 inches above finished floor to top of fire extinguisher.

B. Fire-Protection Cabinets: Fasten fire-protection cabinets to structure, square and plumb.
   1. Unless otherwise indicated, provide recessed fire-protection cabinets. If wall thickness is not adequate for recessed cabinets, provide semirecessed fire-protection cabinets.
   2. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.

C. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

D. Identification: Apply vinyl lettering for field-painted cabinets and wall mounted fire extinguishers at locations indicated.

3.4 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as fire-protection specialties are installed, unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet manufacturer.

E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 104400

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

SECTION 105500 - POSTAL SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. USPS-approved horizontal mail receptacles, with integrated parcel lockers and collection box.
   2. Accessories: Key cabinet.

1.3 SUBMITTALS

A. General: Submit in accordance with Division 01 Section "Submittal Procedures."

B. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of postal specialty.

C. Shop Drawings: For postal specialties. Include plans, elevations, sections, details, and attachments to other work.
   1. Include identification sequence for compartments.
   2. Include layout of identification text.
   3. Include setting drawings, templates, and installation instructions for anchor bolts and other anchorages installed as part of the work of other Sections.

D. Qualification Data: For qualified Installer.

E. Maintenance Data: For postal specialties and finishes to include in maintenance manuals.

F. Other Informational Submittals: Final USPS local postmaster approval for installed postal specialties to be served by USPS.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A firm experienced in installing postal specialties and whose installations have been given final approval by local postmasters authorizing use by USPS.

B. Source Limitations for Each Type of Postal Specialty: Obtain from single source from single manufacturer. For USPS-approved products, use only those included on current lists of USPS manufacturers and models.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver lock keys to Owner by registered mail or overnight package service with a record of each corresponding lock and key number.

1.6 COORDINATION

A. Coordinate layout and installation of recessed postal specialties with wall construction.

B. Templates: Obtain templates for installing postal specialties and distribute to parties involved.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of postal specialties that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures.
      b. Faulty operation of hardware.
      c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
   2. Warranty Period: Five years from date of Substantial Completion.

1.8 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Key Blanks: 50 for each type of compartment-door lock installed.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum: Manufacturer's standard alloy and temper for type of use and finish indicated, and as follows:
   1. Sheet and Plate: ASTM B 209.
   2. Extruded Shapes: ASTM B 221.

B. Steel Sheet: Cold rolled, ASTM A 1008/A 1008M, Commercial Steel (CS), Type B, exposed matte finish where exposed.

C. Die-Cast Aluminum: ASTM B 85, manufacturer's standard aluminum alloy.

D. Steel Anchor Bolts, Nuts, and Washers: ASTM F 1554, Grade 36 or 55, hot-dip galvanized.

2.2 USPS-APPROVED HORIZONTAL MAIL RECEPTACLES

A. Front-Loading, USPS-Approved Horizontal Mail Receptacles: Consisting of multiple compartments with fixed, solid compartment backs, enclosed within recessed wall box. Provide

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

access to compartments for distributing incoming mail from front of unit by unlocking master lock and swinging side-hinged master door to provide accessibility to entire group of compartments. Provide access to each compartment for removing mail by swinging compartment door. Comply with USPS-STD-4C.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Florence Manufacturing; Versatile 4C Front-Load Horizontal Mailboxes or comparable products by one of the following:
   a. Bommer Industries, Inc.
   b. Salsbury Industries.
2. Mail Delivery: USPS.
3. Compartments: Number and size as follows:
   a. Groups of mail receptacles in configuration indicated with single master door, compartments not less than 3 inches high by 12 inches wide by 15 inches deep, outgoing mail collection compartment prepared for master-door lock, and parcel compartment(s): 15 inches high by 12 inches wide by 15 inches deep.
      1) Quantity:
         a) Mail Boxes: 34 minimum.
         b) Parcel Compartments: 3.
         c) Outgoing Mail: 1.
4. Front-Loading Master Door: Fabricated from extruded aluminum and braced and framed to hold compartment doors; prepared to receive master-door lock.
   a. Master-Door Lock: Door prepared to receive lock provided by local postmaster.
5. Compartment Doors: Fabricated from extruded aluminum. Equip each with lock and tenant identification as required by cited standard.
   a. Compartment-Door Locks: Comply with USPS-L-1172C, PSIN O910, for locks and keys, or equivalent as approved by USPS; with three keys for each compartment door. Key each compartment differently.
   b. Door numbers shall be engraved with black in-fill.
   c. Sequencing of door numbers to be determined during Shop Drawing review.
6. Frames: Fabricated from extruded aluminum or aluminum sheet; ganged and nested units, with cardholder and blank cards for tenant's identification within each compartment.
7. Snap-on Trim: Fabricated from same material and finish as compartment doors.
8. Concealed Components and Mounting Frames: Aluminum or steel sheet with manufacturer's standard finish.
9. Exposed Aluminum Finish: Finish surfaces exposed to view as follows:
   a. Anodic Finish: Clear.

2.3 ACCESSORIES

A. Key Cabinet: Wall-mounted, steel cabinet with pivoting, key-holding panels and side-hinged door equipped with five-pin tumbler, cylinder door lock and concealed, full-length flush hinge. Finish cabinet, panels, and door with baked-enamel or powder-coated finish. Provide key control system consisting of key-holding hooks, labels, two sets of key tags with self-locking key holders, key-gathering envelopes, and temporary and permanent markers.
   1. Capacity: Keys for 150 percent of the number of mail-receptacle locks.
   2. Cross-Index System: Consisting of index cards for recording key information. Include three receipt forms for each key-holding hook.
   3. Baked-Enamel or Powder-Coated Finish: Color as selected by Architect from manufacturer's full range.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

4. Location: Where directed by Architect.

2.4 FABRICATION

A. Form postal specialties to required shapes and sizes, with true lines and angles, square, rigid, and without warp, and with metal faces flat and free of dents or distortion. Make exposed metal edges and corners free of sharp edges and burrs and safe to touch. Fabricate doors of postal specialties to preclude binding, warping, or misalignment.

B. Preassemble postal specialties in shop to greatest extent possible to minimize field assembly.

C. Mill joints to a tight, hairline fit. Cope or miter corner joints. Form joints exposed to weather to exclude water penetration.

D. Drill or punch holes required for fasteners and remove burrs. Use security fasteners where fasteners are exposed. If used, seal external rivets before finishing.

E. Weld in concealed locations to greatest extent possible without distorting or discoloring exposed surfaces. Remove weld spatter and welding oxides from exposed surfaces.

F. Fabricate tubular and channel frame assemblies with manufacturer's standard welded or mechanical joints. Provide subframes and reinforcement as required for a complete system to support loads.

G. Fabricate rack ladders to support indicated number of units to form a column of units.

H. Where dissimilar metals will contact each other, protect against galvanic action by applying permanent separation coating as recommended by manufacturers of dissimilar metals.

2.5 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for roughing-in openings, clearances, and other conditions affecting performance of the Work.

B. Examine walls and other adjacent construction for suitable conditions where units will be installed.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

C. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install postal specialties level and plumb, according to manufacturer's written instructions and roughing-in drawings.
   1. Where dissimilar metals will be in permanent contact with each other, protect against galvanic action by painting contact surfaces with bituminous coating or by applying other permanent separation as recommended by manufacturer for this purpose.
   2. Where aluminum will contact grout, concrete, masonry, or wood, protect against corrosion by painting contact surfaces with bituminous coating.
   3. Final acceptance of postal specialties served by USPS depends on compliance with USPS requirements.

B. Horizontal Mail Receptacles: Install horizontal mail receptacles with center of tenant-door lock cylinders and bottom of compartments at the maximum and minimum heights above finished floor established by USPS and manufacturer's written instructions.
   1. Install removable-core and keyed-in door lock cylinders as required for each type of cylinder lock.
   2. Install and align two rack ladders for the first column of mail receptacles and one rack ladder for each additional adjacent column of mail receptacles.

3.3 FIELD QUALITY CONTROL

A. Arrange for USPS personnel to examine and test postal specialties served by USPS after they have been installed according to USPS regulations.

B. Obtain written final approval of postal specialties to be served by USPS. Obtain this approval from USPS postmaster that authorizes mail collection for the served installation.

3.4 ADJUSTING, CLEANING, AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as postal specialties are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust doors, hardware, and moving parts to function smoothly, and lubricate as recommended by manufacturer. Verify that integral locking devices operate properly.

C. Touch up marred finishes or replace postal specialties that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by postal specialty manufacturer.

D. Replace postal specialties that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

E. On completion of postal specialty installation, clean interior and exterior surfaces as recommended by manufacturer.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain postal specialties.

END OF SECTION 105500

62 India St
Portland, M
DD

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

SECTION 108500 - BUILDING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. All glass shower doors.
   2. Wire mesh storage lockers for tenants.
   3. Washing machine drain pans.
   4. Knox box.

B. Related Sections include the following:
   1. Division 22 Sections for plumbing drain and piping for washing machine drain pan.
   2. Division 26 for conduit and wiring for commercial laundry equipment and beauty salon equipment.

1.3 SUBMITTALS

A. General: Submit in accordance with Division 01 Section "Submittals Procedures."

B. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, finishes, and method of attachment for each product indicated.
   1. Include detailed information regarding rough-in, blocking and other preparatory work by other trades.

C. Shop Drawings: Show fabrication and installation details for each product specified. Shop Drawings shall indicate materials, gauges, fabrication details, dimensions and method of attachment.

1.4 WORKMANSHIP

A. Insofar as possible, fitting, construction and fabrication of the work shall be executed at shops, ready for delivery and erection at buildings.

B. Provide all holes, connections, and fastenings for and to work of other trades abutting, adjoining, or intersecting work of this Section.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver commercial laundry equipment only after utility rough-in is complete and construction in spaces to receive appliances is ready for installation.

B. Do not deliver storage lockers until spaces to receive them are clean, dry, and ready for installation.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for manufacturer and product selection:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
   2. Product: Subject to compliance with requirements, provide one of the products specified.

2.2 ALL GLASS SHOWER DOORS

A. All Glass Shower Doors: Frameless tempered glass door and hinge panel, 72 inches high, providing 3 inches of door width adjustment.
   1. Product: Kohler Finial, Pivot Shower Doors.
      a. 3/8-inch thick tempered glass door, size as required for opening.
         1) Glass: CleanCoat glass coating. Clear or frosted as selected by Architect.
      b. Stationary Hinge Panel: 1/2-inch thick tempered glass sidelite.
      c. Door Handle: 14 inch solid brass with brushed nickel or bright silver finish as selected by Architect.
         1) Kohler 1065081 (K-705767).
      d. Jamb and Brackets: Brushed nickel or bright silver finish as selected by Architect.

2.3 WIRE MESH STORAGE LOCKERS

A. Provide storage lockers formed from wire mesh and having the following characteristics:
   1. Manufacturer: Cogan Wire and Metal Products Ltd.; Safegarde Single Tier Storage Units.
   2. Unit Sizes:
      a. Single Tier Units: 36 inches wide by 36 inches deep by 96 inches high.
   3. Unit components shall be as follows:
      a. Mesh: 6 and 8 gage galvanized steel wire woven into 2-by-2-inch rectangular mesh.
      b. Wall Panels: 1-1/4-by-1-1/4-inch by 12 gage steel angle framing on top, bottom, sides and back panels; with wire mesh welded to framing.
      c. Doors: Fabricated from same mesh as wall panels, with framing fabricated from 1-1/4-by-1-1/4-inch by12 gage steel angles on 4 sides with diagonal rod, 1/2-inch diameter, reinforcement; with wire mesh welded to framing. Include manufacturer's standard hinges, door strike and padlock hasp.
      d. Tops: Fabricated from same mesh and framing as doors.
      e. Horizontal Divides/Shelves: Fabricated from same mesh, framing and reinforcement as doors.
      f. Finish: Manufacturer's standard powder coat.

2.4 WASHING MACHINE DRAIN PANS

A. Washing Machine Drain Pans: High Density polyethylene base with 3 inch high containment sides, smooth bottom to accommodate standard shower-type drain, 5/8-inch perimeter attachment flange. Drain, trap and piping provide in Division 22 - Plumbing.
   1. Product: FloodSaver Model WMBD32.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

2.5 KNOX BOX

A. Knox Box: Flush mount with masonry anchorage kit, finish to be selected by Architect. Coordinate order placement with Fire Department authorization. Coordinate mounting height and location in field with Architect.
   1. Finish: As selected by Architect.

B. Product: Knox Company; Knox Box, Series (verify with local fire department).

2.6 FABRICATION

A. General: Materials shall be free from defects impairing strength, durability or appearance.

B. Sections and shapes shall be rolled, formed, drawn or extruded as required for respective functions.

C. Molded work shall have sharply defined profile and shall be clean and straight. Plain work shall be leveled, straight and surfaces true and smooth. Edges, angles, and corners shall be square, clean and sharp, unless otherwise detailed.

D. Fastenings, exposed metal fastenings, and accessories, unless Underwriters' prohibit for safety, shall be of same materials, texture, color and finish as the base metal to which applied.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installers present, for compliance with requirements for installation tolerances, and other conditions affecting performance of work.

B. Examine roughing-in for electrical and plumbing systems to verify actual locations of piping and electrical connections before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. All items specified under this Section shall be installed in strict accordance with manufacturer's recommendations and approved Shop Drawings.

3.3 CLEANING AND PROTECTION

A. Clean building specialties in accordance with manufacturer's instructions. Touch up factory-applied finishes to restore damaged or soiled areas.

B. Provide final protection and maintain conditions that ensure building specialties are without damage or deterioration at the time of Substantial Completion.

END OF SECTION 108500

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

SECTION 124813 - FLOOR MATS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
1. Entrance mats in surface-mounted frames.

1.3 SUBMITTALS

A. General: Submit in accordance with Division 01 Section "Submittal Procedures."

B. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

C. Shop Drawings: For floor mats and frames. Show assembly, joint locations, installation details, layout, plans, elevations, sections, accessories, anchors, and attachments to other Work.

D. Maintenance Data: For floor mats to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Accessibility Requirements: Provide installed floor mats that comply with Section 4.5 in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)."

PART 2 - PRODUCTS

2.1 ENTRANCE MATS

A. Carpet-Type Walk-Off Mats: Polyamide nylon 6,6 fiber, 100 percent solution dyed, bonded to vinyl backing to form mats 3/8 inch thick with nonraveling edges; weight shall be 99 oz./sq. yd.
1. Edge Treatment: Prepared for installation in angle frame.
2. Mat Size: As indicated.
3. Product: Mats, Inc.; New York Collection.
a. Color: As selected by Architect from manufacturer's full range of options.

B. Surface-Mounted Aluminum Frame: Extruded aluminum angle edge-frame with 1/8-inch wide exposed face. Provide with floor anchorage devices, mitered corners, and sizes recommended by manufacturer.
1. Color: Clear anodized.
2. Location: Where frame abuts change in flooring.
3. Product: Aluminum "L-Frame"; Mats, Inc.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

2.2 FABRICATION

A. Floor Mats: Shop fabricate units to greatest extent possible in sizes as indicated. If not otherwise indicated, provide single unit for each mat installation; do not exceed manufacturer's recommended maximum sizes for units that are removed for maintenance and cleaning. Where joints in mats are necessary, space symmetrically and away from normal traffic lanes.

B. Surface-Mounted Frames: As indicated for permanent surface-mounted installation, complete with corner connectors, splice plates or connecting pins, and postinstalled expansion anchors.

2.3 ALUMINUM FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and floor conditions for compliance with requirements for location, sizes, and other conditions affecting installation of floor mats and frames.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install surface-type units to comply with manufacturer's written instructions at locations indicated; coordinate with entrance locations and traffic patterns.
   1. Anchor fixed surface-type frame members to floor with devices spaced as recommended by manufacturer.

3.3 PROTECTION

A. After completing frame installation, provide temporary filler of plywood or fiberboard in recesses and cover frames with plywood protective flooring. Maintain protection until construction traffic has ended and Project is near Substantial Completion.

B. Defer installation of floor mats until Project is near Substantial Completion.

END OF SECTION 124813

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

SECTION 142100 - ELECTRIC TRACTION ELEVATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes machine room-less, self-supporting electric traction passenger elevators.

B. Related Requirements:
1. Division 03 Section "Cast-in-Place Concrete" for setting sleeves, inserts, and anchoring devices in concrete.
2. Division 05 Section "Metal Fabrications" for the following:
   a. Hoist beams.
   b. Structural-steel shapes for subsills.
   c. Pit ladders.
   d. Sump pit cover and support.
3. Division 07 Section "Cementitious Waterproofing" for waterproofing elevator pit.
4. Division 09 Section "Carpet" for finish flooring in elevator cars.
5. Division 22 Sections for sump pumps in elevator pits.
6. Division 26 Sections for electrical service to elevator, including fused disconnect switch, standby power source, transfer switch and telephone.
7. Division 21 and 26 Sections for smoke detectors in elevator lobbies to initiate emergency recall operation and heat detectors in shafts to disconnect power from elevator equipment before sprinkler activation and for connection to elevator controllers.

1.3 DEFINITIONS

A. Definitions in ASME A17.1/CSA B44 apply to work of this Section.

B. Defective Elevator Work: Operation or control system failures; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; the need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.

1.4 ACTION SUBMITTALS

A. Product Data: Include capacities, sizes, performances, operations, safety features, finishes, and similar information. Include product data for car enclosures, hoistway entrances, and operation, control, and signal systems.
1. Power Information: Horsepower, starting current, running current, machine and control heat release, and electrical requirements.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

B. Shop Drawings:
   1. Include plans, elevations, sections, and large-scale details indicating service at each landing, control closet layout**,** coordination with building structure, relationships with other construction, and locations of equipment.
   2. Include large-scale layout of car-control station and standby power operation control panel.
   3. Indicate maximum dynamic and static loads imposed on building structure at points of support, and maximum and average power demands.

C. Samples for Selection: For finishes involving color selection.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Seismic Qualification Certificates: For elevator equipment, accessories, and components, from manufacturer.
   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
   3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Manufacturer Certificates: Signed by elevator manufacturer certifying that hoistway, pit, and control closet layout and dimensions, as shown on Drawings, and electrical service including standby power generator, as shown and specified, are adequate for elevator system being provided.

D. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For elevators to include in emergency, operation, and maintenance manuals.

B. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having jurisdiction for normal, unrestricted elevator use.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Elevator manufacturer or an authorized representative who is trained and approved by manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle materials, components, and equipment in manufacturer's protective packaging. Store materials, components, and equipment off of ground, under cover, and in a dry location.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1.9 COORDINATION

A. Coordinate installation of sleeves, block outs, elevator equipment with integral anchors, and other items that are embedded in concrete or masonry for elevator equipment. Furnish templates, sleeves, elevator equipment with integral anchors, and installation instructions and deliver to Project site in time for installation.

B. Coordinate locations and dimensions of other work relating to electric traction elevators including pit ladders; sumps and floor drains in pits; entrance subsills; electrical service; and electrical outlets, lights, and switches in hoistways, pits, and control rooms.

C. Pre-Ordering Conference: Meet with the Architect and Owner to review elevator operations and functions before ordering.

1.10 WARRANTY

A. Manufacturer's Special Warranty: Manufacturer agrees to repair, restore, or replace elevator work that fails in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, operation or control system failure, including excessive malfunctions; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.
   2. Warranty Period: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide ThyssenKrupp Elevator; Synergy Gearless Traction Elevators, Self-Supporting Standard Series or following product:
   1. Otis Elevator Co.; Gen2 Comfort.

B. Source Limitations: Major elevator components, including driving machines, controllers, signal fixtures, door operators, car frames, cars, and entrances, shall be manufactured by elevator manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with ASME A17.1/CSA B44.

B. Accessibility Requirements: Comply with Section 407 in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and with ICC A117.1.

C. Seismic Performance: Elevator system shall withstand the effects of earthquake motions determined according to ASCE/SEI 7 and shall comply with elevator safety requirements for seismic risk Zone 2 or greater in ASME A17.1/CSA B44.

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1. The term "withstand" means "the system will remain in place without separation of any parts when subjected to the seismic forces specified."
2. Affected peak velocity acceleration (Av) for Project's location is greater than or equal to 0.10, but less than 0.20 (seismic risk Zone 2).
3. Provide earthquake equipment required by ASME A17.1/CSA B44.
4. Provide seismic switch required by ASCE/SEI 7.
5. Elevator Seismic Zone: 2A.
6. Design earthquake spectral response acceleration short period (Sds) for Project is 0.223.
7. Project Seismic Design Category: B.
8. Elevator Component Importance Factor: 1.0

2.3 ELEVATORS

A. Elevator System, General: Manufacturer's standard elevator systems. Unless otherwise indicated, manufacturer's standard components shall be used, as included in standard elevator systems and as required for complete system.

B. Elevator Description:
1. Machine Location: Hoistway; no machine room is provided.
2. Machine Type: Gearless traction.
3. Rated Load: 3500 lb.
4. Rated Speed: 150 fpm.
5. Travel Distance: 32 feet ±.
6. Landings: Four.
7. Operation System: Selective-collective automatic operation.
8. Auxiliary Operations:
   a. Battery-powered lowering.
   b. Earthquake Emergency Operation: Comply with requirements in ASME A17.1/CSA B44.
   c. Automatic dispatching of loaded car.
   d. Nuisance call cancel.
   e. Priority service at all floors.
   f. Loaded-car bypass.
   g. Shunt trip protection.
   h. Automatic light and fan shut down.
9. Car Enclosures:
   a. Inside Width: 80 inches
   b. Inside Depth: 65-1/2inches from back wall to front wall (return panels).
   c. Inside Height: 88 inches to underside of ceiling.
   d. Front Walls (Return Panels): Satin stainless steel, No. 4 finish.
   e. Car Fixtures: Satin stainless steel, No. 4 finish.
   f. Side and Rear Wall Panels: Plastic laminate.
   g. Reveals and Frieze: Satin stainless steel, No. 4 finish.
   h. Door Faces (Interior): Satin stainless steel, No. 4 finish.
   i. Door Sills: Aluminum, mill finish.
   j. Canopy: Cold-rolled steel with white finish and hinged exit.
   k. Ceiling: Satin stainless steel, No. 4 finish with round LED fixtures.
   l. Handrails: 1-1/2 inches round satin stainless steel, No. 4 finish, at sides and rear of car.
   m. Floor prepared to receive carpet specified in Division 09 Section "Carpet".
   n. Ventilation: Manufacturer's standard exhaust fan, mounted on the car top.

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

10. Hoistway Entrances (Public Side):
    a. Width: 42 inches
    b. Height: 84 inches.
    c. Type: Single-speed side sliding.
    d. Frames: Satin stainless steel, No. 4 finish.
    e. Doors: Satin stainless steel, No. 4 finish.
    f. Sills: Aluminum, mill finish.
11. Hall Fixtures: Satin stainless steel, No. 4 finish.
12. Additional Requirements:
    a. Provide inspection certificate in each car, mounted under acrylic cover with frame made from satin stainless steel, No. 4 finish.
    b. Provide hooks for protective pads in all cars and one complete set(s) of full-height protective pads.
13. Car Top Inspection: Provide a car top inspection station with an "Auto-Inspection" switch, an "emergency stop" switch, and constant pressure "up and down" direction and safety buttons to make normal operating devices inoperative. Station will give inspector complete control of elevator. Car top inspection station shall be mounted in door operator assembly.

2.4 TRACTION SYSTEMS

A. Elevator Machines: Variable-voltage, variable-frequency, ac-type hoisting machines and solid-state power converters.
1. Provide nonregenerative system.
2. Provide line filters or chokes to prevent electrical peaks or spikes from feeding back into building power system.
3. Building Power: 208 V, 3-phase, 4 wire. Elevators shall have 15 horsepower. Manufacturers providing an elevator motor with greater horsepower shall be responsible for cost of upgrading disconnect and wiring.
4. Special Features: Battery backup for controlled descent to lowest level of egress in event of power loss.

B. Inserts: Furnish required concrete and masonry inserts and similar anchorage devices for installing guide rails, machinery, and other components of elevator work. Device installation is specified in another Section.

C. Machine Beams: Provide framing to support elevator hoisting machine and deflector sheaves from the building structure. Comply with Division 05 Section "Metal Fabrications" for materials and fabrication.

D. Car Frame and Platform: Welded-steel units.

E. Guides: Roller guides or polymer-coated, nonlubricated sliding guides. Provide guides at top and bottom of car and counterweight frames.

2.5 OPERATION SYSTEMS

A. General: Provide manufacturer's standard microprocessor operation systems as required to provide type of operation indicated.

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

B. Auxiliary Operations: In addition to primary operation system features, provide the following operational features for elevators where indicated:
   1. Single-Car Battery-Powered Lowering: Battery backup for controlled descent to lowest level of egress in event of power loss.
   2. Automatic Dispatching of Loaded Car: When car load exceeds 80 percent of rated capacity, doors begin closing.
   3. Nuisance Call Cancel: When car calls exceed a preset number while car load is less than a predetermined weight, all car calls are canceled. Preset number of calls and predetermined weight can be adjusted.
   4. Loaded-Car Bypass: When car load exceeds 80 percent of rated capacity, car responds only to car calls, not to hall calls.
   5. Automatic Light and Fan Shut Down: The control system shall evaluate the system activity and automatically turn off the cab lighting and ventilation fan during periods of inactivity. The settings shall be field programmable.

2.6 DOOR REOPENING DEVICES

A. Infrared Array: Provide door reopening device with uniform array of 36 or more microprocessor-controlled, infrared light beams projecting across car entrance. Interruption of one or more light beams shall cause doors to stop and reopen.

B. Nudging Feature: After car doors are prevented from closing for predetermined adjustable time, through activating door reopening device, a loud buzzer shall sound and doors shall begin to close at reduced kinetic energy.

2.7 CAR ENCLOSURES

A. General: Provide enameled-steel car enclosures to receive removable wall panels, with car roof, access doors, power door operators, and ventilation.
   1. Provide standard railings complying with ASME A17.1/CSA B44 on car tops where required by ASME A17.1/CSA B44.

B. Materials and Finishes: Manufacturer's standards, but not less than the following:
   1. Floor Finish: Provided in Division 09 Section "Carpet."
   2. Plastic-Laminate Wall Panels: Manufacturers standard plastic laminate covered panel with plastic-laminate panel backing and manufacturer's standard protective edge trim. Panels have a flame-spread index of 25 or less, when tested according to ASTM E 84. Plastic-laminate color, texture, and pattern as selected by Architect from elevator manufacturer's full range.
   3. Fabricate car with recesses and cutouts for signal equipment.
   4. Fabricate car door frame integrally with front wall of car.
   5. Stainless-Steel Doors: Flush, hollow-metal construction; fabricated from stainless-steel sheet.
   6. Sight Guards: Provide sight guards on car doors.
   7. Sills: Extruded metal, with grooved surface, 1/4 inch thick.
   8. Metal Ceiling: Flush stainless steel panels, with LED downlights in each panel.
   9. Handrails: Manufacturer's standard handrails, of shape, metal, and finish indicated.

62 India Str
Portland, M
DD
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

2.8 HOISTWAY ENTRANCES

A. Hoistway Entrance Assemblies: Manufacturer's standard horizontal-sliding, door-and-frame hoistway entrances complete with track systems, hardware, sills, and accessories. Frame size and profile shall accommodate hoistway wall construction.
   1. Where gypsum board wall construction is indicated, frames shall be self-supporting with reinforced head sections.

B. Fire-Rated Hoistway Entrance Assemblies: Door and frame assemblies shall comply with NFPA 80 and be listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction based on testing at as close-to-neutral pressure as possible according to NFPA 252 or UL 10B.
   1. Fire-Protection Rating: 1-1/2 hours.

C. Materials and Fabrication: Manufacturer's standards, but not less than the following:
   1. Stainless-Steel Frames: Formed from stainless-steel sheet.
   2. Stainless-Steel Doors: Flush, hollow-metal construction; fabricated from stainless-steel sheet.
   3. Sight Guards: Provide sight guards on doors matching door edges.
   4. Sills: Extruded metal, with grooved surface, 1/4 inch thick.
   5. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M.

2.9 SIGNAL EQUIPMENT

A. General: Provide hall-call and car-call buttons that light when activated and remain lit until call has been fulfilled. Fabricate lighted elements with LED lamps and acrylic or other permanent, non-yellowing translucent plastic diffusers LEDs.

B. Car-Control Stations: Provide manufacturer's standard semirecessed car-control stations. Mount in return panel adjacent to car door unless otherwise indicated.
   1. Mark buttons and switches for required use or function. Use both tactile symbols and Braille.
   2. Provide "No Smoking" sign matching car-control station, either integral with car-control station or mounted adjacent to it, with text and graphics as required by authorities having jurisdiction.

C. Emergency Communication System: Two-way voice communication system, with visible signal, which dials preprogrammed number of monitoring station and does not require handset use. System is contained in flush-mounted cabinet, with identification, instructions for use, and battery backup power supply.

D. Firefighters' Two-Way Telephone Communication Service: Provide flush-mounted cabinet in each car and required conductors in traveling cable for firefighters' two-way telephone communication service specified in Division 26 Sections.

E. Car Position Indicator: Provide illuminated, digital-type car position indicator, located above car door or above car-control station. Also, provide audible signal to indicate to passengers that car is either stopping at or passing each of the floors served. Include travel direction arrows if not provided in car-control station.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

F. Hall Push-Button Stations: Provide one hall push-button station at each landing.
   1. Provide units with flat faceplate for mounting with body of unit recessed in wall.
   2. Equip units with buttons for calling elevator and for indicating direction of travel or destination as required by system; two buttons at intermediate landings; one button at terminal landings. Provide a signaling system to verify floor selection, where destination registration is required, and to direct passengers to appropriate car.

G. Hall Lanterns: Units with illuminated arrows; but provide single arrow at terminal landings. Provide the following:
   1. Manufacturer's standard wall-mounted units, for mounting above entrance frames.

H. Hall Annunciator: With each hall lantern, provide audible signals indicating car arrival and direction of travel. Signals sound once for up and twice for down.

I. Hall Position Indicators: Provide illuminated, digital-display-type position indicators, located above hoistway entrance at ground floor. Provide units with flat, satin stainless steel faceplate for mounting and with body of unit recessed in wall.
   1. Integrate ground-floor hall lanterns with hall position indicators.

2.10 FINISH MATERIALS

A. General: Provide the following materials for exposed parts of elevator car enclosures, car doors, hoistway entrance doors and frames, and signal equipment as indicated.

B. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, commercial steel, Type B, exposed, matte finish.

C. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, commercial steel, Type B, pickled.

D. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304.

E. Stainless-Steel Bars: ASTM A 276, Type 304.

F. Stainless-Steel Tubing: ASTM A 554, Grade MT 304.

G. Aluminum Extrusions: ASTM B 221, Alloy 6063.

H. Plastic Laminate: High-pressure type complying with NEMA LD 3, Type HGS for flat applications and Type BKV for panel backing.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elevator areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work. Examine hoistways, hoistway openings, and pits as constructed; verify critical dimensions; and examine supporting structure and other conditions under which elevator work is to be installed. Verify walls are plumb where openings occur and are ready for entrance sill installation.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

B. If unacceptable conditions are encountered, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions, requirements of ASME A17.1 and approved Shop Drawings.

B. Coordination: Coordinate elevator work with work of other trades for proper time and sequence to avoid construction delays. Use established benchmarks, lines, and levels to ensure dimensional coordination of the Work.

C. Welded Construction: Provide welded connections for installing elevator work where bolted connections are not required for subsequent removal or for normal operation, adjustment, inspection, maintenance, and replacement of worn parts. Comply with AWS standards for workmanship and for qualifications of welding operators.

D. Sound Isolation: Mount rotating and vibrating equipment on vibration-isolating mounts to minimize vibration transmission to structure and structure-borne noise due to elevator system.

E. Lubricate operating parts of systems, including ropes, as recommended by manufacturers.

F. Alignment: Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with car. Where possible, delay final adjustment of sills and doors until car is operable in shaft. Reduce clearances to minimum, safe, workable dimension at each landing.

G. Leveling Tolerance: 1/8 inch, up or down, regardless of load and travel direction.

H. Set sills flush with finished floor surface at landing. Fill space under sill solidly with nonshrink, nonmetallic grout.

I. Locate hall signal equipment for elevators as follows unless otherwise indicated:
   1. Place hall lanterns either above or beside each hoistway entrance.
   2. Mount hall lanterns at a minimum of 72 inches above finished floor.

3.3 FIELD QUALITY CONTROL

A. Acceptance Testing: On completion of elevator installation and before permitting elevator use (either temporary or permanent), perform acceptance tests as required and recommended by ASME A17.1/CSA B44 and by governing regulations and agencies.

B. Operating Test: Load elevator to rated capacity and operate continuously for 30 minutes over full travel distance, stopping at each level and proceeding immediately to the next. Record temperature rise of elevator machine during 30-minute test period. Record failure to perform as required.

C. Advise Owner, Architect, and authorities having jurisdiction in advance of dates and times that tests are to be performed on elevators.

62 India Str
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Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

D. In the event the equipment does not meet all requirements of the Specifications, Elevator Subcontractor shall promptly remove from premises, all work condemned by Architect as failing to conform to Contract, and shall promptly replace and re-execute work in accordance with Contract without expense to Owner. Elevator Subcontractor shall bear all expense of making good all work of other Contractors destroyed or damaged by such removal or replacement.

E. Obtain State of Maine elevator inspection certificate.

3.4 PROTECTION

A. Temporary Use: Do not use elevators for construction purposes.

B. Provide protective coverings, barriers, devices, signs, and other procedures to protect each elevator. If, despite such protection, elevator becomes damaged, engage elevator Installer to restore damaged work so no evidence remains of corrective work. Return items that cannot be refinished in field to shop, make required repairs and refinish entire unit, or provide new units as required.

C. Provide final protection and maintain conditions, in a manner acceptable to elevator manufacturer and Installer that ensure elevators are without damage or deterioration at the time of Substantial Completion

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to operate elevator. Review emergency provisions, including emergency access and procedures to be followed at time of failure in operation and other building emergencies. Train Owner's personnel in procedures to follow in identifying sources of operational failures or malfunctions. Confer with Owner on requirements for a complete elevator maintenance program. Coordinate instruction with the availability of the Owner's personnel.

B. Check operation of elevator with Owner's personnel present before date of Substantial Completion and again not more than one month before end of warranty period. Determine that operation systems and devices are functioning properly.

3.6 MAINTENANCE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include twelve months' full maintenance by skilled employees of elevator Installer. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper elevator operation at rated speed and capacity. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
   1. Perform maintenance during normal working hours.
   2. Include 24-hour-per-day, 7-day-per-week emergency callback service with response time of two hours or less.

END OF SECTION 142100

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

SECTION 21 13 13 - WET-PIPE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. The work covered by this Section of the specifications includes the furnishing of labor, materials, equipment, transportation, permits, inspections and incidentals and the performing of operations required to design, install and test a pressurized, fully supervised, wet or dry pipe fire protection system for full building protection in accordance with NFPA, IBC, the City of Portland Fire Department and the Owner's insurance underwriter. Areas subject to freezing shall have a dry pipe system, dry pendent or sidewall heads, or glycol-and-water loop per NFPA. Provide a 4" standpipe in each stairwell with a 2½" valve at each floor. Provide multiple risers, as required.

B. The sprinkler systems design shall be based on NFPA13 requirements.

1.2 RELATED DOCUMENTS

A. The drawings and the specifications including Divisions 22, 23, 26 are hereby made a part of the work of this section.

1.3 QUALIFICATIONS

A. The Fire Protection Work shall be performed by a qualified Contractor primarily engaged in the design and installation of Fire Protection Systems. The fire protection system design shall be performed under the direction of, and sealed by, a professional engineer registered in the State of Maine or NICET III certification.

B. Welding qualifications of individuals installing welded piping shall be certified by the National Certified Welding Bureau for the type(s) of weld(s) proposed for use in piping assembly.

1.4 SUBMITTALS

A. Items for which the submittal requirements of section 22 & 23, apply are as Follows:

1. Hydrant flow test.
2. System components.
3. Hydraulic calculations.
4. Piping layout, details and control diagram.
5. Flushing and testing records.
6. Certificate of installation.
7. Copy of Fire Protection Contractors License.
8. Welding certificates of individual welding technicians.
9. Sprinkler heads.
10. Alarm valve(s).
11. Fire department connection(s).
12. Firestopping materials and methods.

Submit hydrant flow test, equipment descriptive data, hydraulic calculations and system layout for review by the Owner's Insurance Underwriter. Submit the system layout to the Architect for review. The Architect's review will be limited to checking for conformance with the design concept of the project and general compliance with the contract documents and will in no way assume liability for review for compliance with codes, standards and laws.

1.5 SPRINKLER COVERAGE

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

A. Sprinkler head coverage shall conform with NFPA requirements for the use of the building. Coverage shall be increased accordingly where required by the Authority having jurisdiction.

B. If the requirements of the inspection agency or the Owner's insuring agent are more rigorous than those stated herein, then the more rigorous requirements shall govern.

PART 2 - PRODUCTS

2.1 SYSTEM COMPONENTS AND HARDWARE

A. Pipe, Fittings, Joints, Hangers, Valves, Fire Department Connections, Alarms: Conform to NFPA-13, Installation of Sprinkler Systems.

B. Sprinkler Heads:

1. Interior Heated Spaces: Conform to NFPA-13, commercial quick response type. Provide semi-recessed type with white finish for acoustical tile ceilings. Sprinkler heads in GWB ceilings shall be “concealed” type. Dry pendent or sidewall heads, where required, may be standard response type.

2. Provide a spare head cabinet with wrenches, the amount of spare heads for each orifice size, finish, temperature classification, pattern and length furnished in the project shall be in accordance with the following schedule:

Sprinkler Heads on Project	Number of Spare heads of each type.
Less than 300	6
300-999	12
1000 or more	24

3. Provide head protection guards where required.

4. Sprinkler heads in unheated areas shall be dry pendent or sidewall type, or served by a glycol and water loop or separate dry-pipe system.

C. Fire Department Connection: Provide a 4" Storz connection or siamese connection (as verified with the local fire department) at a location coordinated with the local fire department and the Architect.

2.2 WATER SUPPLIES

A. Conform to the requirements of NFPA-13, Installation of Sprinkler Systems.

2.3 DEVICES

A. Detection devices and associated low voltage and line voltage wiring both within the fire protection system and to the building Fire Alarm System shall be the responsibility of the Sprinkler Contractor.

2.4 BACKFLOW PREVENTER

A. Provide AMES MODEL 2000.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

2.5 PIPING SYSTEM IDENTIFICATION

A. Piping system and valve identification and color coding shall be in accordance with ANSI.

2.6 ELEVATOR SHAFTS AND MACHINE ROOM

A. Sprinkler elevator shafts and elevator machine room per NFPA and the Maine State Elevator Code.

2.7 CEILING CAVITIES

A. Ceiling cavities above all suspended acoustical tile ceilings in corridor areas and certain other areas contain bundled electrical cables and individual wires and shall be sprinklered. Coordinate sprinkler requirements with the Electrical Drawings.

2.8 FLEXIBLE SPRINKLER HOSE FITTINGS

A. Manufacturer: FlexHead Industries, Inc., Viking or Victaulic “Aquaflex”.

1. Contact: 56 Lowland Street, Holliston, MA 01746; Telephone: (800) 829-6975; Fax: (508) 893-6020; Email: sales1@flexhead.com; website: www.flexhead.com

B. Description: Flexible Sprinkler Hose Fittings for use in commercial suspended ceilings and sheetrock ceilings.

1. Regulatory Requirements:

a. In accordance with NFPA 13.

C. Product Performance Criteria:

1. FM Approved for its intended use pursuant to FM 1637 Approval Standard for Flexible Sprinkler Hose with Threaded End Fittings.
2. UL Listed for its intended use pursuant to UL 2443 Standard for Flexible Sprinkler Hose with Fittings for Fire Protection Service.
3. Seismically qualified for use pursuant to ICC-ES AC-156 Acceptance Criteria for Seismic Qualification by Shake-Table Testing of Nonstructural Components and Systems.

D. Materials: FlexHead Commercial Sprinkler Connections.

1. FlexHead Flexible Hose Assemblies and End Fittings:

a. Composition: 100% Type 304 Stainless Steel.
b. Straight Hose Assembly Lengths: 2ft length, Model #2024 or 3ft length, Model #2036.
   1. ¾ inch outlet.
   2. 175 psi maximum rated pressure.
   3. Fully welded non-mechanical fittings, braided, leak-tested with minimum 1 inch true-bore internal corrugated hose diameter.
c. Elbow Hose Assembly Lengths(For use in confined spaces): 2ft length, Model #2024E or 3ft length, Model #2036E.
   1. ¾ inch outlet.
   2. 175 psi maximum rated pressure.
   3. Fully welded non-mechanical fittings, braided, leak-tested with minimum 1 inch true-bore internal corrugated hose diameter.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

2. FlexHead Ceiling Bracket:

   a. Composition: Type G90 Galvanized Steel.
   b. Type: Direct attachment type, having integrated snap-on clip ends positively attached to the ceiling using tamper-resistant screws.
   c. Flexible Hose Attachment: Removable hub type with set screw.

3. Do not use product where exposed, concealed only.

2.9 SPRINKLER SYSTEM ZONING

A. The building shall have area zone alarms to connect to the building fire alarm panel (five (5) total zones). Each floor shall be a separate sprinkler system zone. Each zone alarm shall consist of a flow switch, isolation valve with tamper switch and other components per NFPA. See Architectural Drawings for additional information. Coordinate with the Portland Fire Department. Coordinate with the Electrical Contractor and Fire Alarm Contractor.

PART 3 - EXECUTION

3.1 PIPING LAYOUT AND DESIGN

A. System requirements, installation requirements, design, plans, and calculations: Conform to NFPA-13, Installation of Sprinkler Systems.

B. Sprinkler piping shall be run concealed above ceilings in occupied areas where possible. Piping in other areas may be run exposed. Piping shall not be exposed in occupied spaces unless indicated on the drawings or accepted by the Architect.

C. Pipe penetrations through walls and floors shall be in accordance with Section 23 05 00 – Common Work Results for HVAC. Traverse points of piping shall be escutcheoned with split chrome floor and ceiling plates and spring anchors, where visible to occupancy. Penetrations through walls shall be sleeved in accordance with Section 23 05 00. Sleeves shall be provided by the Fire Protection Contractor.

D. Coordinate design and layout with building structure and building systems. The work shown in the contract documents has precedence for space requirements. Work of other trades may be modified or moved only with permission of the trade involved. Costs associated with modifications or relocations shall be the same as for "Substitutions" Section 23 05 00.

E. For areas with acoustical tile ceilings, sprinkler heads shall be located in the center of acoustical tiles. Coordinate with the Reflected Ceiling Plans. The Architect shall review the proposed system layout and reserve the right to relocate heads, substitute head system and in general review final layout for components visible in occupied spaces.

3.2 SYSTEM ACCEPTANCE

A. Approval, flushing, hydrostatic testing, instructions, and certificates of installation: Conform to NFPA-13, Installation of Sprinkler Systems.

B. Disinfect the water piping in accordance with AWWA C601. Fill the piping systems with solution containing a minimum of 50 parts per million of available chlorine and allow solution to stand for minimum of 24 hours. Repeat disinfection if chlorine residual is less than 10 parts per million after 24 hours. Flush the solution from the systems with clean water until maximum residual chlorine contents is not greater than 0.2 parts per million.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

C. Closing in Work:

1. General: Cover up or enclose work after it has been properly and completely reviewed.

2. No additional cost to the Owner will be allowed for uncovering and recovering, work that is covered or enclosed prior to required review and acceptance.

D. Cleanup and Corrosion Prevention:

1. Upon completion of the work thoroughly clean and flush piping systems to the sewer with water.

2. Piping and equipment shall be thoroughly cleaned. Dirt, dust, and debris shall be removed and the premises left in a clean and neat condition.

3. Before uncovered piping is permitted to be concealed, corrosion and rust shall be wire brushed and cleaned and in the case of iron products, a coat of approved protective paint applied to these surfaces. When corrosion is from the effects of hot solder paste, the areas shall be cleaned and polished and a wash of bicarbonate of soda and water used to neutralize the acid condition.

E. Instructions: On completion of the project, provide a technician familiar with the system to thoroughly instruct the Owner's representative in the care and operation of the system. The total period of instruction shall not exceed four (4) hours. The time of instruction shall be arranged with the Owner.

F. Warranty: For a period of one (1) year after completion of the installation repair or replace any defective materials or workmanship. Upon completion of the installation, the system shall be turned over to the Owner fully inspected and tested, and in operational condition.

3.3 FIRESTOPPING

A. Firestopping shall be performed in accordance with Specification Section 07 84 00 “Firestopping”. All penetrations of fire-rated assemblies including walls and floors by mechanical system components (piping, ductwork, conduits, etc.) shall be firestopped as specified.

* END OF SECTION *

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

DIVISIONS 22 AND 23

REQUIREMENTS FOR MECHANICAL / PLUMBING WORK

Systems Description and Performance Criteria for Design / Build Procurement

PART 1 - GENERAL

1.1 SUMMARY

A. The Mechanical Contractor shall be responsible for the mechanical design and construction of the building and provide mechanical specifications and construction drawings stamped by a mechanical engineer licensed to practice in the State of Maine. The mechanical work includes providing all labor, materials, equipment, consumable items, supervision, administrative tasks, tests and documentation required to provide complete and fully operational mechanical systems. The mechanical contractor shall completely coordinate the work of this section with the work of other trades.

B. The mechanical contractor shall file documents, obtain permits and licenses, pay fees and obtain necessary inspections and approvals from all applicable authorities that have jurisdiction.

C. The mechanical contractor's work shall begin at the utility connection 5 feet outside the building foundation. Mechanical work shall be complete from point of service to each space with all accessory construction and materials required to make each item of equipment or system complete and ready for operation. Mechanical systems shall include the following:

1. Apartments: all occupied spaces shall be heated/cooled with dedicated VRF energy recovery heat pump system(s), one unit per apartment with dedicated exterior unit. Locations of exterior units shall be coordinated with Architect but in general can be located on the roof or on the ground. Apartment ventilation will be provided by individual exhaust fans for bathrooms and kitchen cooking area. Wall caps to be places on rear of building. Front apartment vents shall be run horizontally to the rear of the building and out through wall caps. Supply air shall be provided by packaged rooftop units by Greenheck or Cook, located as directed by the Architect and shall include MERV8 filters and heating and cooling coils. The units shall be double-wall construction with hinged and latched quick-release access doors. Kitchen hood(s) will be ducted to the rear of the building. The HVAC system shall allow simultaneous heating or cooling in any zone. The rooftop units shall be provided with water tight drain pans under entire exterior perimeter of equipment with a condensate overflow switch and alarm. Room temperature sensors shall be electronic and shall have a blank display without setpoint adjustment. Each apartment shall have dedicated unit(s). Common areas can consist of multiple spaces with similar solar exposure and occupancy. Zoning diagram shall be provided for review by engineer. New NG services including all piping shall be the responsibility of the MC. Each apartment will have clothes dryer vents that shall be installed by MC. Wall caps shall be on rear of building dryer exhaust booster fans may be required.

2. Ground floor tenant spaces – Served by Packaged NG fired split systems with condensing units on the roof and will provide Heating/cooling and ventilation for the commercial tenant spaces.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

3. House space: Normally unoccupied areas such as stairwells and storage rooms shall be heated with cab heaters or unit heaters and ventilated per ASHRAE and IMC. Nat gas fired boiler installed in utility space wit hydronic pumps and piping system. Common areas can consist of multiple spaces with similar solar exposure and occupancy. Zoning diagram shall be provided for review by engineer. New Propane services including all piping shall be the responsibility of the MC.

3. System design will be in conformance with the IECC, IBC, IMC, NFPA, ASHRAE and MUBEC Maine Energy Standards.

Plumbing

1. The building shall be served by water and sewer utilities from the Waterville Water/sewer district. Existing water service to remain. Domestic water pressure booster system shall be supplied and installed to maintain adequate water pressure at top floor apartments. Coordinate with water/sewer district with architectural floor plans. Plumbing fixtures shall be provided as indicated on the Architectural drawings and shall comply with the Maine State Plumbing Code. Fixture type and manufacturer will be Kohler, Eljer, American-Standard, or equal. Apartment bathrooms toilets shall be tank type, tub/showers and sinks shall be approved by architect. Public restrooms water closets shall be 1.28 GPF wall mount flush valve type as indicated with electronic (infrared) controls. Lavatories shall be vitreous china, wall-mounted or countertop type as indicated by Zurn, Kohler or American-Standard. Urinals shall be 1.0 pint per flush. All fixtures will be water-conserving type and ADA-compliant where applicable. Floor drains shall be provided in the toilet / shower rooms and at the water service and in the mechanical room. Provide electronic trap primers by PPP, Inc. or Zurn for each floor drain and pipe to each floor drain trap. A minimum of four (4) exterior frost-proof sillcocks shall be provided. Coordinate locations with the Owner and Architect. ADA showers shall have hand held showerhead, fold-up seat and grab bars per ANSI. Fixed head showers shall be 1.5 GPM. The shower threshold shall be ¾". The domestic water heaters shall be electric one for each apartment located in a closet. The domestic hot water system shall be recirculated by an all-bronze or stainless steel circulator. Water hammer arrestors shall be provided where required. Plumbing fixtures see Appendix A.

2. Provide elevator sump pumps and associated piping system.

3. Provide roof drains and roof drain piping as required. Provide overflow roof drains and piping as required. Roof drains shall be Zurn or equal.

1.2 SUBMITTALS

A. The following information shall be submitted to the Architect in a timely manner allowing for review and revision as may be necessary before work is begun:

1. Name, address and telephone number of the Maine licensed mechanical engineer.

2. Detailed engineering documents, drawings and specifications, as prepared and stamped by the engineer of record.

B. Manufacturer's product data and installation instructions for each material and product proposed for use in areas exposed to view.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

PART 2 - DESIGN CRITERIA

A. Load Calculations: Shall be performed in accordance with procedures and methods as described in ASHRAE Handbook of Fundamentals and ASHRAE GRP-158 Cooling and Heating Load Calculation Manual. Loads shall be calculated for each zone of control, for each air system, and for the building total peak load.

1. General Data:

Weather Data Location - Portland, ME
Latitude: 44°
Outdoor Design Temperatures:

Winter: -10°F
Summer: 86°F dry bulb/72°F wet bulb (coincident)
74°F wet bulb

Building hours of operation: 24 hours/day, 7 days/week, or as specified by the Owner.

Internal Gain: Lighting: as designed
Equipment: as scheduled
People: 315 BTUH sensible, 325 BTUH latent

Indoor Temperature and Relative Humidity (conditioned spaces only):

Relative humidity: 25-60%RH
Summer (conditioned spaces only): 75°F
Winter: 70°F

Population Density: per ASHRAE standards for occupied spaces or as provided by the Owner.

Ventilation Rate: ASHRAE Standard 62.

Roof: R-Value 35
Exterior Walls: R-Value 21
Windows / Glass: U-Value .25
Infiltration: 1/2 air change/hr minimum, not coincident with ventilation load.

B. System Design:

1. Zones of Control: Each major use area or exposure shall constitute an independent thermostatically-controlled zone. Each major space will be individually zoned and temperature controlled – proposed zones. Provide supplemental perimeter heat where required (vestibule, restrooms, storage spaces, lounges,etc.).

2. Air Device Selection: Diffusers shall be selected to provide the design airflow in each zone. One, two, three, or four way patterns may be used. The diffuser shall be selected such that the room noise criteria (Nc) does not exceed the scheduled values, and the diffuser throw results in room air velocities less than 50 FPM and greater than 20 FPM in the occupied zone. Manufacturers catalog data throw data shall be corrected for actual ceiling height. Manufacturer's noise data shall be adjusted to delete any arbitrary credit taken for room absorption, and shall be corrected to reflect the actual

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

number of diffusers in the space an actual room absorption. Return grilles shall be selected using the same noise limitations outlined for diffusers. Air device performance ratings shall be Air Diffusion Council (ADC) certified.

3. Low Pressure Ductwork: Shall be designed for a maximum pressure drop of 0.08" WG per 100 ft. of duct. Acoustical duct liner (Armaflex SA) shall be applied to rectangular ductwork as required to assure that design room noise (Nc or RC) levels are not exceeded.

4. Piping: Water piping shall be sized for a maximum velocity of 4 ft./sec. Piping systems shall be designed within the criteria indicated in the ASHRAE Handbooks.

5. Energy Recovery Unit and Air-Cooled Chiller: Shall be sized to provide the peak building ventilation air quantity at the static pressure calculated. The air-cooled chiller unit EER shall meet and qualify for Efficiency Maine rebates contractor to coordinate paperwork for owner.

6. Pumps: Provide four (4) main in-line hot water and chilled water pumps with “lead-lag” control. Pumps shall be Taco, Wilo, Bell and Gossett or Grundfos with variable speed control. Select pumps so that the operating point on the selected impeller-curve will lie at or to the left (shut-off side) of, and not more that 5 percent below, the point of maximum efficiency for the impeller. Selected catalog data submitted for approval shall include pump speed and characteristic curve for performance of impeller selected for each pump. Curves shall indicate capacity vs head, efficiency, and brake horsepower for full range, from shut-off to free delivery.

7. Acoustical considerations: Sound-producing HVAC equipment shall not be located in or adjacent to acoustically sensitive areas.

8. Exhaust Fans: Shall be provided for ventilation of all bathrooms, janitor closets, and special exhaust. Fans shall be sized for double code required ventilation. Fans shall be selected such that the specified acoustic levels are not exceeded in the occupied spaces.

9. Automatic Temperature Control - Furnishing of labor, materials, equipment, transportation, permits, inspections and incidentals and the performing of operations required to install the automatic temperature control system indicated and be connected to the Owner’s building management system. The system shall be Direct Digital Control to provide the sequences as described below. The ATC system shall be complete including required components including, low voltage and line voltage wiring.

    a. Rooftop AHU:

        1) The unit shall operate continuously.

        2) Discharge Air Temperature Control: Shall be determined by the central control panel and space temperatures.

        3) Economizer Cooling: When the outside air conditions are suitable, the enthalpy economizer shall function for natural cooling. The heat wheel shall stop when in economizer mode.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

4) Freeze Protection: A manual reset freezestat located in the discharge ductwork (in the heated space) shall shut down the fan and close the outside air damper if the discharge supply temperature falls below 45°F (adjustable).

5) Duct smoke detectors in the discharge and return air shall de-energize the unit and close the outside air dampers. The smoke detector shall be wired to interface with the building fire alarm system.

b. Exhaust Fans: Toilet rooms shall have an exhaust fan on low speed continuously and wall switch to ramp up to higher level.

10. Return Air Ductwork:

a. Return air shall be ducted directly from each space. Return air plenums shall not be used.

PART 3 PRODUCTS

3.1 PIPING MATERIALS

A. Heating hot water piping: CPVC or PEX or Type L hard copper tubing with cast bronze or wrought copper solder fittings or Schedule 40 carbon steel pipe. Fittings for steel pipe are as indicated in paragraph "Fittings for Steel Pipe".

B. Chilled Water piping: CPVC or PEX or Type L hard copper tubing with cast bronze or wrot copper solder fittings or Schedule 40 carbon steel pipe. Fittings for steel pipe shall be as indicted in paragraph “Fittings for Steel Pipe”.

C. Soil and Waste (Sanitary) and Vent Piping: Cast iron with push-on joints below grade. Cast iron "no Hub" above grade. Sanitary piping shall be cast iron. Vent piping may be PVC at contractor's option, cast iron (ONLY) thru roof.

D. Domestic Water Piping:

1. Above Slab: PEX or Schedule 40 CPVC, Flowguard Gold with solvent-welded joints, or equal, or Type L hard copper tubing and cast bronze or wrought copper solder fittings. Piping concealed in walls may be PEX.

E. Exposed Water and Waste Piping at Fixtures: I.P.S. copper with cast brass fittings chrome plated finish, with deep one piece escutcheon plates at traverse points.

F. Solder: Lead-free (ONLY), Englehard Silvabrite 100, 440°F melting point, ASTM B32.

3.2 VALVES

A. Ball Valves:

1. 1/2" thru 2" copper, Apollo Model 70-203 thru 70-208.
2. 1/2" thru 2" IPS, Apollo Model 70-103 thru 70-108.
3. 1½" thru 4" IPS, Victaulic style 721.

B. Gate Valves: Nibco.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1. 1/2" thru 2", copper, Model S-113.
2. 1/2" thru 2-1/2" IPS, Model T-113.

C. Check Valves:

1. 1/2" thru 2" copper, Nibco Model S-413.
2. 1/2" thru 2" IPS, Nibco Model T-413.
3. 2" thru 4" IPS, Victaulic series 712.

D. Butterfly Valves:

1. 2½" thru 6", 150 psi working pressure, Centerline or Norris. Lug type, iron body, 316SS disc and shaft, Buna-N seat.

E. Outside Screw and Yoke (OS&Y) Gate Valves: Nibco Class 250 Model F-667-0, iron body, flanged.

3.3 FITTINGS FOR STEEL PIPE

A. Fittings in sizes 1/2" through 2": Steel or malleable iron with requirements as follows:

1. Steel fittings socket welding or screwed type conforming to ANSI B16.11.

2. Malleable iron fittings screwed type conforming to ANSI B16.3.

3. Victaulic rolled or cut grooves with rigid couplings and flexible couplings where required for expansion.

B. Fittings in sizes 2½" and larger:

1. Butt welding type conforming to ANSI B16.9.

2. Flanged type conforming to ANSI B16.5.

3. Victaulic rolled or cut grooves with rigid coupling and flexible couplings where required for expansion.

C. Steel Flanges: Forged steel, welding type conforming to ANSI B16.5. Bolting and gaskets shall be as follows:

1. Bolting: Material used for bolts and studs shall conform to ASTM A 307, Grade B, and material for nuts shall conform to ASTM A 194, Grade 2. Dimensions of bolts, studs, and nuts shall conform to ANSI B18.2.1 and ANSI B18.2.2 with threads conforming to ANSI B1.1 coarse type, with Class 2A fit for bolts and studs, and Class 2B fit for nuts. Bolts or bolt-studs shall extend completely through the nuts.

2. Gaskets: Gaskets shall be of a material that resists attack by the fluid or gas in the pipeline and shall be suitable for the pressure and temperature ranges encountered. Gaskets shall be as thin as the finish of surfaces will permit. Raised-face steel flanges shall have ring gaskets with an outside diameter extending to the inside of the bolt holes. Gaskets shall have an inside diameter equal to or larger than the port openings.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

D. Butt Weld Joints: Shall conform to ANSI B31.1. The use of backing rings shall conform to ANSI B31.1. Ferrous rings shall be of weldable quality and shall not exceed 0.05 percent sulfur. Backing rings shall be of the continuous machined or split band type.

3.4 HANGERS

A. Adjustable Swivel Hanger: Carpenter and Paterson Fig. 800 or Clevis hanger Carpenter and Paterson Fig. 100.

B. Riser Clamp: Carpenter and Paterson Fig. 126 for steel pipe and Fig. 126 CT for copper tube.

3.5 PIPING SPECIALTIES

A. Thermometers: Hot Water and Chilled Water Service - Trerice, No. V80445, or Ashcroft with a 4½" diameter face. System thermometers shall have a range of 30^{o}F to 240^{o}F (hot water) or 0-100^{0}F. (chilled water) with 2^{o} increments. Provide with brass thermometer wells projecting a minimum of 2" into the pipe with extension to face of insulation.

B. Pressure Gauges: Gauges shall be 3½" case, Trerice Series 800, or Ashcroft installed with shut off petcock, 0-100 psig.

C. Expansion Tanks: Taco Model CA butyl bladder type expansion tank, full acceptance volume, ASME rated for 125 psig working pressure and 240^{o}F maximum temperature, air-charging fitting, drain fitting.

D. Strainers: 125 psig minimum rating wye strainers, with blowdown valve; as manufactured by Sarco or Barnes and Jones.

E. Automatic Air Vents: Armstrong air vent traps No.1-AV 1/2" with stainless steel trim. Other acceptable manufacturers are Amtrol, Sarco or Hoffman. Valves shall be installed with each vent. Drains from the vents shall be run to the nearest indirect waste.

F. Manual Air Vents: Consist of air chamber with a 3/8" pipe off the top and a 3/8" ball valve. The valve shall be installed in an accessible location. An air chamber shall be installed at each air vent and shall be line size for piping smaller than 2" and 2" for larger piping.

G. Pumps: Taco, Wilo, Grundfos or Bell and Gossett in-line centrifugal pumps, cast iron body, bronze fitted, 1750 rpm, 175 psig working pressure, 250^{o}F working temperature, flanged connections. Motors shall be premium high efficiency with variable speed with differential pressure control.

H. Balancing Valves: Armstrong circuit setter.

1. Balancing devices shall have provisions for connecting a portable differential pressure gauge. Each balancing device to be sized to provide a differential pressure reading between 2 and 5 feet with the valve full open at design flow rates.

2. Install per manufacturer's recommendations for adjacent length of straight pipe.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

3. Balancing devices shall have memory stops for use as a tight shutoff without disturbing the balancing setting.

4. Balancing devices shall have drain connections with shutoffs.

5. Shop drawings shall indicate gpm, size, wide open differential pressure meter reading, and actual water pressure drop.

I. Flexible Connectors:

1. Pumps: Mason Industries Model MFTNC neoprene connectors, rated at 150 psig and 220°F.

J. Triple Duty Valve: Taco "Plus One" combination gate, check and balancing valve with metering connections, cast iron body, 175 psig working pressure. Valves shall be sized to provide a differential pressure reading between 2 and 5 ft. with the valve full open at design flow rates.

K. Water Pressure Reducing Valve: Watts Regulator Series USB with thermal expansion bypass, integral stainless steel strainer, 140°F maximum temperature, 175 psig working pressure, 25 to 75 psi reduced pressure range.

L. Backflow Preventer: Watts Regulator Series 909 double check valve backflow preventer, 175 psig working pressure, 210°F working temperature, bronze body, stainless steel seats, shafts and bolts.

M. Air Separator: Taco Model 4900AD dirt and air separator, screwed or flanged connections, 125 psig design pressure.

3.6 CABINET UNIT HEATERS (CUH)

A. Cabinet unit heaters shall be manufactured by Sterling. The cabinet shall be 16 gage steel, factory prime coated, and enamel finished with color selection by Architect. Furnish two, throw-away type, filters for each heater. Heaters shall be equipped with permanent split capacitor motors suitable for 120 volt, 60 cycle, single phase current. Motors shall have automatic reset integral thermal overload protection, extended motor oilers, and shall be high efficiency type for ducted units (high static pressure). Coils shall be of seamless copper tube mechanically expanded into aluminum fins. Coils shall be tested for leaks at 300 psig. Furnish with unit-mounted speed switch (3-speed). Units shall be concealed with ducted connections, semi-recessed, inverted airflow, or wall-mounted, inverted airflow as scheduled on drawings.

3.7 HORIZONTAL UNIT HEATERS

A. Sterling, hot water coils single tube, single serpentine, totally enclosed motors. Sizes and capacities as required. Ratings as required. Electric: 120V-1PH-60HZ.

3.8 PIPE INSULATION

A. Hot Water and Chilled Water Piping and Equipment: Knauf or Johns-Manville, heavy density fiberglass with thermal conductivity of 0.29 BTU-in/hr-ft^2-°F at 150°F mean temperature. Insulation shall be suitable for 1000°F service. Pipe fitting insulation shall be same material used for pipe.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

B. Domestic Hot Water, Cold Water, Roof Drain Piping and Equipment: Knauf or Johns-Manville, heavy density fiberglass with thermal conductivity of 0.29 BTU-in/hr-ft^2-^{o}F at 150^{o}F mean temperature. Insulation shall be suitable for 1000^{o}F service. Pipe fitting insulation shall be same material used for pipe.

C. Insulation Jacket: All service (ASJ) type, with maximum flame spread of 25, fuel contribution of 50 and smoke developed of 50 (ASTM E84). Jacket permeability shall not exceed 0.02 perms (ASTM E96). Pipe fitting jacket shall be molded PVC covers with pressure sensitive taped joints.

D. See "Execution" section for insulation thickness.

3.9 DUCT INSULATION AND ACOUSTIC LINING

A. Duct Insulation: Fiberglass duct wrap with foil-scrim-kraft facing/vapor barrier, 1.0 lb/cu.ft. density, 0.29 but-in/hr-sf-^{o}F conductivity, 0.05 permeance rating, fire hazard classification (flame/fuel/smoke) 25/50/50. Insulation shall meet the requirements of NFPA 90A & B and shall be UL rated.

B. Acoustical Duct Lining: Acoustic lining and insulation: Armstrong Type SA “Armaflex” closed cell, installed in accordance with the manufacturers recommendations.

3.10 SHEETMETAL WORK AND MATERIALS

A. Low Pressure Ductwork (Static Pressure $\leq$ 2" WG):

1. Rigid Ductwork: Galvanized steel conforming to ASTM A527, weight of galvanized coating shall be not less than 1-1/4 ounces total for both sides of one sq. ft. of a sheet. Construction, metal gage, and reinforcements shall conform with SMACNA "Duct Construction Standards" and NFPA 90A for 1" W.G. pressure class for exhaust ductwork, return ductwork.

2. Low Pressure Flexible Ductwork: Wiremold Type "WG" with 1" thick thermal insulation. The duct shall be suitable for working pressures up to 10" WG.

3. Access Doors: Ruskin Model ADC2, 10"x10" size, 24 gauge galvanized steel, steel on both sides of door, foam gasket seals, 1" insulation, 4 cam locks, no hinge.

4. Turning Vanes: Solid, single blade, mounted with the long edge down stream.

5. Spin-in Fittings: General Environmental Corporation "Genflex" Model SM-2DE or Model SM-2DEL.

6. Manual Balancing Dampers: Ruskin Model MD-35 opposed blade with locking quadrant.

B. Access Doors:

1. Low Pressure Duct Systems: Ventlok 10" x 12" or as indicated with #99 Ventlok cam locking latches and no hinge.

C. Automatic Control Dampers:

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1. Automatic dampers not furnished as an integral part of an item of equipment shall conform to this paragraph. Automatic dampers shall be constructed and installed in accordance with the following Minimum Standards and shall be Arrow "Arrow-Foil" Model PBDAF-206, OBDAF-207 or Ruskin Model CD-50:

    a. Damper Blades: Automatic dampers, including dampers for static pressure control, shall be of the balanced type, factory-fabricated, with fully gasketed extruded aluminum airfoil blades, mounted in welded frames. Damper blades shall be not more than 8 inches wide, shall have interlocking edges and be capable of operation against 4" static pressure differential.

    b. Proportioning Dampers: Proportioning dampers shall be of the opposed blade type.

    c. Damper Size and Bearings: Damper blades shall have steel trunnions mounted in oil-impregnated bearings. Dampers shall be not more than 48 inches in length between bearings.

    d. Frames: Damper frames shall be of welded channel or angle-iron, with heavy steel corner gussets and braces or stiffened with steel tie-rods where necessary. Frames shall be painted with aluminum paint to prevent rusting.

    e. Dampers shall be guaranteed to close tight, and shall provide substantially the full area of the opening when open. Outdoor air intakes and exhaust ducts to outside and fresh air, return air and exhaust air dampers in systems shall have damper blades with inflatable seals or other devices to guarantee low leakage, not to exceed 6 CFM/SF at 1 in. WG pressure differential.

    f. Damper Linkages: Damper-operating links shall be steel or brass rods, adjustable in length with ball and socket joints and of such proportions that they will withstand, without appreciable deflection, a load equal to not less than twice the maximum operating force of the damper motor. Linkages shall be concealed in the frame.

D. Louvers: Ruskin ELF-6375DX, box frame, for masonry walls, drainable blade, extruded aluminum construction. Provide 1/2" expanded metal bird screen on interior. Louver finish shall be Kynar 500, color selected by Architect. Coordinate sizes, shapes and locations with the architectural drawings. Pitch duct connecting to louver toward outside to facilitate draining. Seal duct water tight at connection point to louver. Refer to architectural drawings for further details.

E. Fire Dampers: Ruskin Model IBD2 curtain type with blades out of the airstream, 1½ Hr. rated in accordance with UL and NFPA requirements in all horizontal and vertical penetrations.

F. Volume Extractors: Anemostat Model DTA, adjustable, with worm gear operator accessible thru the branch opening. Unit shall be suitable for tight shut-off.

G. Flexible Collars and Connectors: Ventfabrics, Inc. "Ventglass" neoprene coated glass fabric.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

H. Joint Sealant: For ductwork that is not visible from finished spaces, use Hardcast, Inc., type DT5300 gypsum impregnated tape and Model FTA-20 activator/adhesive for indoor applications.

3.11 FANS

A. Fans shall be Greenheck, Cook Ventilator, or Penn Ventilator. Fans shall be furnished with a safety switch or other suitable disconnect switch and backdraft damper or motorized damper. Provide 12" high insulated roof curbs and curb seals.

3.12 GRILLES, REGISTERS AND DIFFUSERS (Price, Krueger, Titus or Metalaire)

A. Ceiling Diffusers: Square neck louver faced with "lay-in" type frame (Krueger Model DL) for acoustic tile ceilings and or flanged frame (Model DF), for drywall ceilings pattern as required.

B. Return Grilles: Rectangular neck, 45^{o} curved blade 1/2" blade spacing, for acoustic the ceilings (Model SAC35LD), or 3/4" blade spacing for acoustic ceilings (Model SAC3LD), 3/4" blade spacing with flanged frame for drywall ceilings (Model S3HD), and 1/2" blade spacing with flanged frame for plaster ceilings (Model S35HD). Straight blade, 3/4" spacing, flanged frame (Model S3HS).

C. Exhaust Grilles: Square neck, 45^{o} curved blade 1/2" spacing, aluminum construction.

D. Transfer Grilles: Square neck, 45^{o} curved blade 1/2" spacing with lay-in frame (Model SAC35LD) or flanged frame (Model S35HD).

E. Supply Register: Rectangular neck, double deflection, front blades horizontal, steel construction with 1/2" blade spacing (Model S25HO) or 3/4" blade spacing (Model S2HO). Registers shall be provided with opposed blade balancing dampers.

F. Supply Grille: Square neck, double deflection, steel construction, front blades horizontal, 1/2" spacing (Model S25H), or 3/4" spacing (Model S2HO).

3.13 ROOFTOP AIR HANDLING UNITS

A. Greenheck, Cook, or equal. Sizes, types and performance shall be as required. The supply air shall be conditioned to the space requirements. Units shall be provided with a non-fused disconnect switch, magnetic motor starters, controls, hot water heating coil(s), chilled water cooling coils and dampers, roof curbs, piping vestibules and filter sections. Nameplates shall be fixed to the unit. Installation and maintenance bulletin shall be supplied with each unit. Locations of units including service access requirements shall be coordinated with the Architect during design.

B. Cabinet:

1. Unit cabinet shall be insulated, weatherproof and designed to operate at a total static pressure up to 4.5". Furnish with intake and exhaust hoods.

2. Exterior panels of sections shall be double-wall construction with 18-gauge or heavier galvanized steel exterior sheetmetal and 22 gauge (minimum) interior liner. Access doors downstream of the supply air fan section shall include 20-gauge galvanized steel door liners. (Galvanized steel liners shall be provided on access doors and over floor insulation in traffic areas.)

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

3. Hinged, latched and gasketted access doors shall be provided for each section.

C. Supply Air Fan Section:

1. Supply fans shall be double width, double inlet centrifugal, forward curved (FC), airfoil (AF), backward curved (BI) type. Fans shall be statically and dynamically balanced for quiet operation. The forward curved fan wheel and housing shall be fabricated from steel. Backward curved and airfoil fan wheels shall be Class II type and fabricated from aluminum with the fan blades continuously welded to the back plate and end rim, and shall operate in a galvanized steel housing. Units shall have solid steel shafts mounted in heavy-duty greasable ball bearings. The entire fan assembly shall be completely isolated from the unit bulkhead with neoprene gasketing and mounted on double deflection spring isolators.

2. Fan motors shall be heavy-duty, 1800 RPM, open drip-proof type with greasable ball bearings, operating at 60 Hz, 3 phase. Motors shall be premium high efficiency. The motors shall have a variable pitch sheave and be mounted on an adjustable base for proper alignment and belt tension adjustment.

E. The filter section shall be supplied with galvanized steel filter racks as an integral part of the unit. Filters shall be accessible from both sides of the unit. The prefilter section shall be provided with panel filters. Panel prefilters shall be MERV8, 2" thick throwaway pleated media type mounted in a galvanized steel filter frame. The panel filter section shall be designed for face velocities not to exceed 380 FPM. Filters shall be rigid 2" thick extended media disposable type, MERV8 of 40% efficiency as tested by ASHRAE test standard 52-76. Filters shall have a minimum average arrestance of 95% in accordance with that standard.

F. Submit fan curves for each fan with the design operating point clearly marked.

G. Submittal data shall include sound power data for inlet, discharge and radiated sound. CAUTION: Submittals without this data will be rejected.

3.14 FANCOIL UNITS

A. Trane, McQuay or Envirotech, 4-pipe, with hot water heating and chilled water cooling coils, ducted arrangement, filters, drain pan and condensate overflow switch. Units shall be insulated and have a high external static pressure motor, ECM, or equal.

PART 4 EXECUTION

4.1 DESIGN AND INSTALLATION OF PIPING SYSTEM

A. Provide and erect in accordance with the best practice of the trade piping system required to complete the intended installation. Make offsets as required to place piping in proper position to avoid other work and to allow the application of insulation and finish painting to the satisfaction of the Owner.

B. The size and general arrangements, as well as the methods of connecting piping, valves, and equipment, shall be as designed, or so as to meet the requirements of the Owner.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

C. Piping system shall be erected so as to provide for the easy and noiseless passage of fluids under working conditions. Inverted eccentric reducing fittings shall be used whenever water pipes reduce in size.

D. Water mains shall be run level or pitch slightly upward so that no air pockets are formed in the piping. The mains shall be set at elevations such that the runouts feeding equipment shall have no pockets where air can collect except where vents are provided. Provide drains at low points in the piping systems.

E. Piping shall be run concealed above ceilings in occupied areas.

F. In the design of water piping, make proper allowances for expansion and contraction. Piping shall be anchored as necessary to control expansion. Loop water runouts to units shall come off the main downward or off the side with a minimum of two 90^{o} elbows provided on runout from main.

G. Install stop valves and unions to facilitate maintenance and removal of equipment.

H. Steel piping 2" and smaller shall have screwed connections, or Victaulic connections. Threads on piping must be full length and clean-cut with inside edges reamed smooth to the full inside bore. Close nipples shall not be used.

Pipe threads shall be standard pipe threads, machine cut and full length. Pipe shall be reamed to remove burrs and up-ended and rapped to dislodge dirt and scale. Joint compound shall be applied to male thread only. If necessary to back off a screwed joint after it is made, the thread shall be cleaned and new compound applied. Caulked threads will not be permitted.

I. Steel Piping 2½" and larger shall have welded connections or Victaulic couplings.

1. Welded Joints:

a. Welding Procedure: Before any welding is performed, submit copies of welding procedure for metals included in the work together with proof of qualification as outlined in ANSI B31.1.

b. Performance Qualification Record: Before any welder or operator shall perform any welding, submit 2 copies of the Welder's Performance Qualification Record in conformance with ANSI B31.1 showing that the welder was tested under the approved procedure submitted. In addition also submit each welder's assigned number, letter, or symbol which shall be used to identify the work of the welder, affixed to the joint immediately upon completion of the weld. Welders making defective welds after passing a qualification test shall be given a requalification test and upon failing to pass the test shall not be permitted to work on this project.

c. Previous Qualification: Welding procedures, welders and welding operators previously qualified by test may be accepted for this project without requalification subject to approval of the Owner and provided that the conditions delineated in ANSI B31.1 are met before a procedure can be used.

d. Surface Conditions: Welding shall not be done when the atmospheric temperature is less than 0 degrees F, when the surfaces are wet, when rain or snow is falling or moisture is condensing on the surfaces to be

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

welded, nor during periods of high wind, unless the welder and the work are protected properly. At temperatures between 32 degrees and 0 degrees F, the surfaces for an area within 3 inches of the joint to be welded shall be heated with a torch to a temperature warm to the hand before welding. Surfaces to be welded shall be free from loose scale, slag, rust, paint, oil and foreign material. Joint surfaces shall be smooth, uniform, and free from fins, tears and other defects which might affect proper welding. Slag shall be removed from flame cut edges to be welded by grinding, temper colors need not be removed. Each layer of weld metal shall be cleaned thoroughly by wire brushing prior to inspection and deposition of additional weld metal.

e. Base Metal Preparation: Preparation of pipe ends shall be done by machining and/or grinding, except that oxygen or arc cutting will be permitted on carbon steel pipe only if the cut is reasonably smooth, true and heavy oxide is thoroughly cleaned from the flame cut surfaces by grinding.

The ends of pipe-to-pipe, and pipe-to-fitting, joints shall be aligned accurately within a tolerance of twenty percent of the pipe thickness. Alignment shall be maintained during welding by suitable clamps, jigs, tack welds, or other devices. If tack welds are used to maintain alignment, they shall be kept below the outside surfaces of the pipe and shall not exceed twice the pipe thickness in length or two thirds the pipe thickness in depth, shall be the same quality as the final welds, and shall be fused thoroughly in the final weld. Defective tack welds shall be removed before the final weld is made.

f. Quality of Welds: The quality of welds shall be in accordance with ANSI B31.1. The surface of the finished welds shall have a bright metallic luster after cleaning, shall be fairly smooth with regular, even ripples, and shall be uniform in contour. Except as necessary to correct defects, the surfaces shall not be dressed, smoothed, or finished for improving their appearance. Welds shall be sound throughout and fused thoroughly, and shall be free from gas pockets, oxides, slag inclusions, and surface porosity, except that very small pores or specs of oxides or slag will be allowed if dispersed widely and if not larger or more numerous than those produced in passing qualification tests. Welds shall be free from overlaps, undercuts and excessive convexity. The inside of the pipe shall be free from blobules of weld metal which would restrict the pipe area or might become loose.

g. Correction of Defects: Defective or unsound welds shall be corrected by removing and replacing the welds with new welds, or as follows:

1) Excessive convexity - chip or grind weld to required size.

2) Undercutting, shrinkage cracks, craters, blowholes, and excessive porosity - chip or grind weld to sound weld and base metal and deposit additional weld metal.

3) Undersize and excessive concavity - clean weld and deposit additional weld metal.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

4) Overlapping and lack of fusion - remove weld by chipping or grinding and reweld.

5) Slag inclusions - chip or grind weld to remove slag and fill with weld metal.

6) Removal of adjacent base metal during welding - chip or grind weld to sound base and weld metal and form full size by depositing additional weld metal. Pipe or fittings which cannot be rewelded satisfactorily shall be replaced with new pipe or fittings at the Contractor's expense. Caulking of welds shall not be done. Before adding weld metal or rewelding, the surfaces shall be cleaned thoroughly. The removal of weld metal form a defective weld shall not extend into the base metal beyond the weld penetration. Where incomplete fusion is disclosed by chipping or grinding to correct defects, the part of the weld shall be removed and rewelded. In chipping or grinding welds, the weld or base metal shall not be nicked or undercut.

2. Victaulic Joints:

a. Pipe Preparation: Pipe shall be prepared in accordance with the latest published Victaulic specifications.

1) Standard Weight Pipe: Shall be roll grooved without metal removal or square cut grooved.

2) Plain End for FIT: pipe ends shall be thoroughly cleaned on the OD, for 1" from the pipe end to remove pipe coatings, mill scale, rust and raised weld beads, OD burrs and sharp edges shall be removed. Pipe shall be marked 1-1/2" from the end, and pipe end configuration shall be in conformance with Victaulic specifications.

b. Assembly: Couplings, fittings, valves and pipe shall be assembled in accordance with latest published manufacturer's instructions.

1) Pipe: pipe shall be checked to be certain it is sufficiently free of indentations, projections, grooves, weld seams, or roll marks on the exterior of the pipe over the entire gasket, that pipe ends are square cut and that preparation (grooving, cleaning, hole cutting) is in accordance with Victaulic pipe preparation standards.

2) Gasket: gaskets shall be of the central cavity pressure-responsive design. Gasket style and elastomeric material (grade) shall be checked to be certain gasket supplied is suitable for the intended service.

3) Lubrication: Use manufacturer's recommended lubricant. Lubrication shall be used for proper coupling/fitting assembly as follows: A thin, uniform coat of Victaulic Lubricant shall be applied by brush or by hand by: 1) brushing lubricant on the gasket lips (ID) and the entire exterior of the gasket; 2) brushing lubricant on the pipe ends around the entire pipe circumference and inside with coupling housing.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

J. High points in water piping shall be provided with manual vents.

K. Connections between copper and steel piping shall be made with brass fittings.

L. Thermometers shall be installed in common supply to zones and in each separate circuit return. Install thermometer wells for thermometers projecting a minimum of 2" into the pipe with extension to face of insulation. Piping 2" and smaller shall be enlarged to 1½" where wells are installed.

M. Solder joints shall be made with Harris Stay-Safe 50 lead free solder. Clean surfaces to be soldered and use a paste flux. Wash joints with sodium bicarbonate and water to remove corrosive effects of heated solder paste. Hot wipe solder at each fitting. Lead bearing solder is not permitted.

N. Points of traverse of piping through walls and floors shall be through pipe sleeves of the same material and thickness as the pipe. Sleeves shall be of the next clearance size. Traverse points of piping shall be escutcheoned with split chrome floor and ceiling plates and spring anchors, where visible to occupancy. Insulation shall be continuous thru sleeves.

4.2 PIPE HANGERS

A. Copper Tubing: supported at intervals as follows, with rod sizes as follows, double nuts on hangers and on beam clips.

Copper Size	Hanger Intervals	Rod Sizes
1/2"	5'	3/8"
3/4"	6'	3/8"
1"	6'	3/8"
1-1/4"	7'	3/8"
1-1/2"	8'	3/8"
2"	9'	3/8"
3"	10'	3/8"

B. Iron Pipe: supported at intervals and with rod sizes as follows, double nuts on hangers and on beam clips.

Iron Pipe	Hanger Intervals	Rod Sizes
1/2"	6'	3/8"
3/4"	6'	3/8"
1"	7'	3/8"
1-1/4"	7'	3/8"
1-1/2"	9'	3/8"
2"	10'	3/8"
2-1/2"	11'	3/8"
3"	12'	3/8"
4"	14'	1/2"

C. Verticals: supported at not more than 16 ft. intervals by use of clamp hangers.

4.3 INSULATION OF PIPING AND EQUIPMENT

A. Insulate heating hot water, domestic hot water, roof drain piping and chilled water supply and return piping, condensate piping, equipment, valves and fittings. Fittings shall be mitered fiberglass insulation segments of same thickness as adjacent insulation. Fitting and valve body insulation shall be covered with molded PVC

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

fittings covers. Secure overlap at cover throat with stainless steel tacks. Tape joints with pressure sensitive vapor barrier tape.

B. Hangers: On insulation shields.

C. Unions shall be covered as are fittings but shall have collared enlargement at least 1" larger than the OD of the line insulation.

D. Pipe Insulation Thickness:

1. Hot Water and Chilled Water Supply and Return:

a. 2" and smaller piping - 1" thick.
2½" and larger piping and equipment - 1½" thick.

2. Domestic Cold Water Piping:

a. 2" and smaller piping - 1" thick.
2½" and larger piping and equipment - 1½" thick.

3. Domestic Hot Water and Recirculated Hot Water:

a. 2" and smaller piping - 1½" thick.

4. Roof Drain Piping:

a. 1" thick.

4.4 DESIGN AND INSTALLATION OF DUCTWORK AND AIR DEVICES

A. Provide and erect in accordance with the best practice of the trade ductwork required to complete the intended installation. Make offsets required to place ductwork in proper position to avoid conflicts with other work and to allow the application of insulation and finish painting to the satisfaction of the Owner. Ductwork design shall be accomplished to avoid conflict with architectural and structural design elements. If conflicts cannot be resolved by the Design-Build mechanical contractor, coordinate a solution with the Architect during the design phase. Ducts shall be arranged to adjust to "field conditions". The Sheet Metal trades shall coordinate his work with other trades. Work shall conform to ASHRAE duct construction recommendations, SMACNA "Duct Construction Standards," NFPA, and the requirements of the International Mechanical Code.

B. Construction for Low Pressure Round and Rectangular Ductwork:

1. Metal Gauge:

a. Thickness of metal for low pressure rectangular ducts, including elbows and other fittings, shall be as follows:

Longest Rectangular Dimension of Duct Inches	Galv. Steel & Stainless Steel USS Gauge
Up thru 12	26
13 thru 30	24
31 thru 54	22

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

55 thru 84	20
Over 85	18

b. Thickness of metal for low pressure round ducts, including elbows and other details, shall be as follows:

Duct Diameter Inches	Galv. Steel USS Gauge
Up thru 10	24
11 thru 20	22

2. Round Duct: Use properly sized and beaded male couplings (ONLY). Assembly shall be made in accordance with the manufacturer's recommendations and sealed airtight with the manufacturer recommended duct sealer. The joints shall be fastened in place by three or more sheet metal screws spaced not over eight inches apart.

3. Longitudinal Seams: Longitudinal joints in ducts shall be Pittsburgh lockseams (ONLY). CAUTION: Button punch lock joints are not acceptable.

4. Transverse Joints and Bracing Angles: Transverse joints and bracing angles of rectangular duct shall be as follows:

Duct Size Long Side Inches	Transverse Joints	Bracing Angles Size - Inches	Flat Bar
18 or less	Hemmed S slip	None	None
19 thru 30	Hemmed S slip	1" x 1" x 1/8" @ 60"	1" x 3/16"
31 thru 42	1" Reinforced Bar Slip	1" x 1" x 1/8" @ 60"	1-1/4" x 1/4"
43 thru 60	1-1/2" Reinforced Bar Slip	1-1/2" x 1-1/2" x 1/8" @ 60"	1-1/2" x 1/4"
61 thru 96	1-1/2" Angle Re-inforced Pocket Lock	1-1/2" x 1-1/2" x 3/16" @ 30"	1-1/2" x 1/4"

5. Transverse Joints: Drive slips shall be used on short sides of transverse duct joints if side is less than 24 inches. Metal and thickness of S slips and drive slips shall be same as duct. Ends of drive slips shall be bent over at least 1/2 inch at corners. Bar slips shall be fastened with sheet metal screws on 12 inch centers. Corners of bar slip joints shall be folded over and riveted. Pocket slips shall be riveted to duct on 6-inch centers, and corners shall be overlapped and riveted.

6. Stiffeners: Ducts over 18 inches wide shall be provided with stiffeners, which may be either transverse joints or angle bracing, as indicated above. The center-to-center spacing of stiffeners shall be not over four feet for ducts not

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Date: 04/11/17

exceeding 60 inches (long side) and shall be not over two feet for ducts not exceeding 8 feet in any case. Flat area of uninsulated ducts over 18 inches wide shall be stiffened by cross-breaking. Uninsulated exposed ducts shall have flat bar reinforcement and flush seams in lieu of bracing angles and projecting seams.

7. Bracing Angles: Bracing angles shall be of the same metal as the duct. Angles shall be riveted to the ducts on 6-inch centers, and shall be applied on four sides. On vertical ducts, set of bracing angles shall be located with heel down at the floor line wherever duct passes through floor. End of two opposite angles shall extend as required to catch floor construction.

8. Long Radius Elbows: Long radius elbows shall be constructed with a throat radius equal to not less than the dimensions of the duct width in the plane of the duct turn. Where space does not permit the use of a long radius elbow, vaned mitered elbows shall be provided.

9. Mitered Elbows: Low pressure mitered (square) elbows shall be constructed with single wall turning vanes. A 12" x 12" access door shall be installed adjacent to each elbow with turning vanes.

D. Joint Sealing:

1. Low Pressure Ductwork: lateral duct joints and clinch connections shall be sealed to SMACNA seal Class B.

2. Pressure Taps: Provide near end of each duct run, between components of air handling systems and as required by the Air Balance Subcontractor, pressure taps of 1/4" copper tube, soldered to duct or plenum, and provided with neoprene cap to prevent air leakage. Where required, also provide taps for velocity traverse equipment.

E. Turns shall be made with long radius elbows.

F. Field Changes to Ductwork: Field changes of ducts such as those required to suit the sizes of factory-fabricated equipment actually furnished shall be designed to minimize expansion and contraction. Use 4:1 transitions in field changes as well as modifications to connecting ducts.

G. Deflectors: Provide deflectors in duct-mounted supply outlets, take-off or extension collars to supply outlets, and tap-in branch-off connections. Adjust supply outlets to provide air volume and distribution as indicated.

H. Fire Dampers: Install fire dampers for ducts penetrating fire-rated walls or floors.

I. Access Doors: Provide access doors for automatic dampers, counter balanced dampers, volume dampers, fire dampers, coils, thermostats, temperature controllers, valves, filters, and other concealed apparatus requiring service and inspection in the duct system.

J. Duct Sleeves and Prepared Openings: Install duct sleeves and prepared openings for duct mains, duct branches, and ducts passing through walls, roofs, and ceilings. Ensure the proper size and location of sleeves and prepared openings. Allow one-inch clearance between duct and sleeve or one-inch clearance between insulation and sleeve for insulated ducts, except at grilles, registers, and diffusers.

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Inspections Division
Approved with Conditions
Date: 04/11/17

K. Closure Collars: Provide closure collars of not less than 4 inches wide on each side of walls or floors where sleeves or prepared openings are installed. Fit collars snugly around ducts and insulation. Grind smooth edges of collar to preclude tearing or puncturing insulation covering or vapor barrier. Use nails with maximum 6-inch centers on collars.

L. Duct Supports: Provide duct supports of not less than two one-inch by 1/16 inch galvanized strip-iron hangers spaced one on each side of ducts. Anchor risers in the center of the vertical run to allow ends of riser free vertical movements. Attach supports only to structural framing members and concrete slabs. Anchor supports to metal decking only if a means is provided for preventing the anchors from puncturing the metal decking. Where supports are required between structural framing member, provide suitable immediate metal framing. Where C clamps are used, use retainer clips.

M. Flexible Collars and Connections: Provide flexible collars between fans and ducts or casings and where ducts are of dissimilar metals. For round ducts, securely fasten flexible connections by zinc-coated steel clinch-type draw-band. For rectangular ducts, lock flexible connections to metal collars.

N. Longitudinal joints shall be Pittsburg Hammered Lockseam.

O. Transitions with a slope greater than 4 to 1 will be ordered removed from the system and replaced with a transition which meets this criteria.

P. Installation of Air Devices:

1. Curved blade transfer grilles installed in vertical walls above the line of sight shall be installed with the blade opening facing the ceiling.

2. Curved blade transfer and return grilles installed in ceilings shall be installed with the blade opening facing the nearest wall.

3. Ductwork visible to the occupants thru the face of supply, return, transfer grilles or diffusers shall be painted with flat black paint.

4.5 INSULATION OF DUCTWORK

A. Insulate the concealed supply air ductwork from the Energy Recovery Ventilator units to the diffusers with 1½" thick fiberglass duct wrap with a factory applied “FSK” vapor barrier facing. Laps to be sealed and held in place with sealing tape adhesive and flared staples (sealing tape shall be SMACNA approved). On the bottom of the ducts 24" and wider, mechanical fasteners shall be provided approximately 12" on center.

B. Acoustically line ductwork as required to meet the occupied space acoustic criteria listed (10’ minimum downstream / upstream of all fans). Lining shall be applied to the interior of the ductwork. Acoustic liner shall be applied to the flat sheet metal with adhesive and fabricated in the break. Provide stick clips on 12" centers for additional support in ducts over 12" wide. Liner shall be Armaflex Type SA.

4.6 CLOSING IN UNINSPECTED WORK

A. General: Cover up or enclose work after it has been properly and completely inspected and reviewed.

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Inspections Division
Approved with Conditions
Date: 04/11/17

B. If any of the work is covered or enclosed prior to required inspections and acceptance, uncover the work as required for the test and inspection. After inspection, tests and acceptance, repairs and replacements shall be made by the appropriate trades with such materials as necessary for the acceptance by the Engineer and at no additional cost to the Owner.

4.7 TEST AND ADJUST

A. Supply and return piping shall be tested with water to a pressure of 75 psi and held for a period of two hours. Any leaks shall be repaired and another test applied to the piping. Piping shall be tested before it is insulated.

B. Before operating the system the piping shall be flushed out to remove oil and foreign materials.

C. After the installation is complete and ready for operation, the system shall be tested under normal operating conditions in the presence of the Engineer and demonstrated that the system functions as designed.

D. It shall be demonstrated that the piping systems have free and noiseless circulation of water and that parts including packing glands are tight.

E. If any defects in operation develop during the test periods, correct them immediately and additional tests will then be conducted.

4.8 CLEANING

A. Prior to acceptance of the work, thoroughly clean exposed portions of the installation, removing labels and foreign substance.

4.9 INSTRUCTIONS

A. On completion of the project, provide a competent technician to thoroughly instruct the Owner's representative in the care and operation of the system. The total period of instruction shall not be less than eight (8) hours.

The time of instruction shall be arranged with the Owner. In addition to the prime HVAC Contractor, the control system Contractor, Balancing Contractor, and Owner's representative shall be present and participate in the Owner's instruction.

4.10 EQUIPMENT IDENTIFICATION

A. Each pump, unit heater, fan, damper motor, water circulating pump switch and control device shall be identified with plastic laminated identification tags. Labels and tags shall be Setmark or Seton. "Dymo" type tags are prohibited. Set points shall be indicated on tags.

4.11 TESTING, ADJUSTING AND BALANCING

A. At the conclusion of the installation, the air and water systems shall be tested, adjusted and balanced by certified balancing technicians to provide the required design air and water flow rates. A testing and balancing report shall be delivered to the Owner for review.

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Date: 04/11/17

4.12 PROPYLENE GLYCOL

A. The chilled water system shall be filled with a 40% aqueous solution of propylene glycol and water. The propylene glycol shall be Dowfrost, or equal, with long-life corrosion inhibitors.

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Inspections Division
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Date: 04/11/17

APPENDIX A
PLUMBING FIXTURES

Loft powder room sinks: Kohler Persuade Curv K-2956 w/ Console Table
Bathroom Undermount Sinks: Kohler Verticyl K-882
Guest Bathroom Faucets: Grohe Concetto 34270
Master Bathroom Faucets: Grohe Essence 20297 (to be used in units with only 1 bathroom)
Kitchen Sinks: Elkay Crosstown 30179
Kitchen Faucet: Moen Align 7565

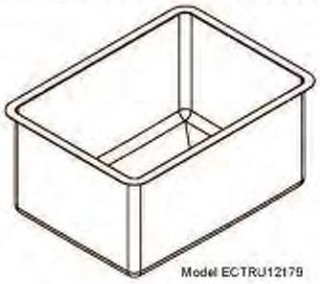
Kitchen Sink: Elkay Crosstown 30179
Kitchen Faucet: American Standard Quince

Bar Sink: Elkay Crosstown 12179
Bar Faucet: Moen Align 7565

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Approved with Conditions
Date: 04/11/17

ELKAY SPECIFICATIONS

Crosstown™ Undermount Single Bowl Sink Model ECTRU12179


Model ECTRU12179

GENERAL
Highest quality sink fabricated of #18 (1.2mm) gauge, type 304 (18-8) nickel bearing stainless steel. Undermount.

DESIGN FEATURES
Bowl Depth: 9" (229mm).
Coved Corners: Approximately 5/8" (15mm).
Finish: Exposed surfaces have a Polished Satin Finish.
Underside: Fully protected by heavy duty Sound Guard® under-coating designed to reduce condensation and dampen sound.

OTHER
Drain Opening: 3-1/2" (89mm).
NOTE: All Elkay undermount sinks are designed to attach to the underside of any solid surface countertop.
Sink complies with ASME A112.19.3/ CSA B45.4

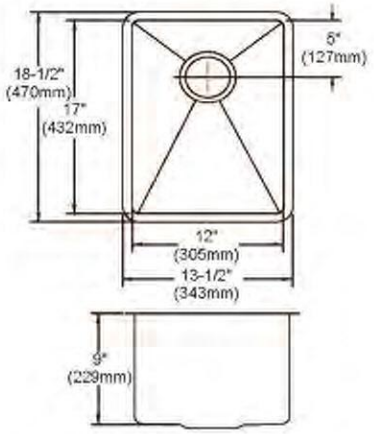
Sinks are listed by IAPMO® as meeting the applicable requirements of the Uniform Plumbing Code®, International Plumbing Code®, and National Plumbing Code of Canada.

OPTIONAL ACCESSORIES
Bottom Grid: GFOBG1217SS
Cutting Board: LKCBF17HW
Mounting Clips: LKUCLIP8
Rinsing Basket: LKFRB715SS
Utensil Caddy for Rinsing Basket: LKWUCSS
Drain: LK35, LK99

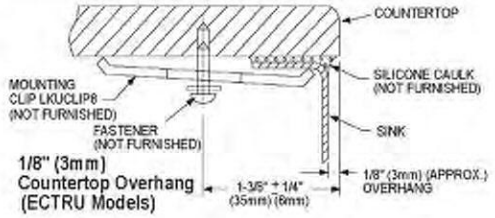
SINK DIMENSIONS*

Model Number	Overall		Inside Bowl			Cutout in Countertop	Minimum Cabinet Size
	L	W	L	W	D		
ECTRU12179	13 1/2 (343mm)	18 1/2 (470mm)	12 (305mm)	17 (432mm)	9 (229mm)	See Template**	18 (457mm)

*Length is left to right. Width is front to back.
**Template is packed with every sink.



Installation Profile of ECTRU Models
The template provided with each ECTRU sink provides the only type of installation recommended by Elkay



In keeping with our policy of continuing product improvement, Elkay reserves the right to change product specifications without notice. Please visit elkayusa.com for most current version of Elkay product specification sheets.

This specification describes an Elkay product with design, quality and functional benefits to the user. When making a comparison of other producers' offerings, be certain these features are not overlooked.

Elkay
elkay.com
elkaypro.com
2222 Camden Court
Oak Brook, IL 60523

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For all Lavatories with exception to the Powder Rooms

KOHLER®

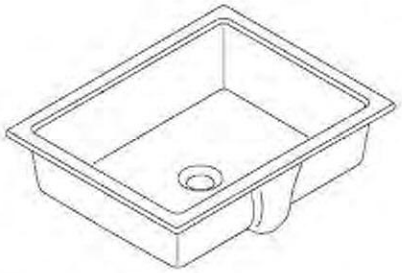
VERTICYL™

Features

UNDER-MOUNT BATHROOM SINK
K-2882

ADA

- *Vitreous china*
- *Under-mount*
- *With overflow*
- *Without faucet hole(s)*
- *Includes 1193643 clamp assembly*
- *17-1/4" (438 mm) x 13" (330 mm)*



Codes/Standards Applicable

Specified model meets or exceeds the following:

- *ADA*
- *ASME A112.19.2/CSA B45.1*
- *ICC/ANSI A117.1*

Colors/Finishes

- 0: White
- Other: Refer to Price Book for additional colors/finishes

Accessories

- CP: Polished Chrome
- Other: Refer to Price Book for additional colors/finishes

Specified Model

Model	Description	Colors/Finishes	
K-2882	Under-mount bathroom sink	☐ 0	☐ Other_____
Recommended Accessories			
K-8998	Adjustable P-Trap	☐ CP	☐ Other_____

Product Specification

The under-mount bathroom sink shall be made of vitreous china. Bathroom sink shall be 17-1/4" (438 mm) in length and 13" (330 mm) in width. Bathroom sink shall be with overflow and without faucet hole(s). Bathroom sink shall include 1193643 clamp assembly. Bathroom sink shall be Kohler Model K-2882-_____.

USA/Canada: 1-800-4KOHLER
(1-800-456-4537)
www.kohler.com

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VERTICYL™

Technical Information

Fixture*:	
Basin area	17-1/4" (438 mm) x 13" (330 mm)
Water depth	3-1/8" (79 mm)
Drain hole	Ø 1-3/4" (44 mm)
* Approximate measurements for comparison only.	

Cutout template	1109226-7

Included components:	
Basin clamp assembly	1193843

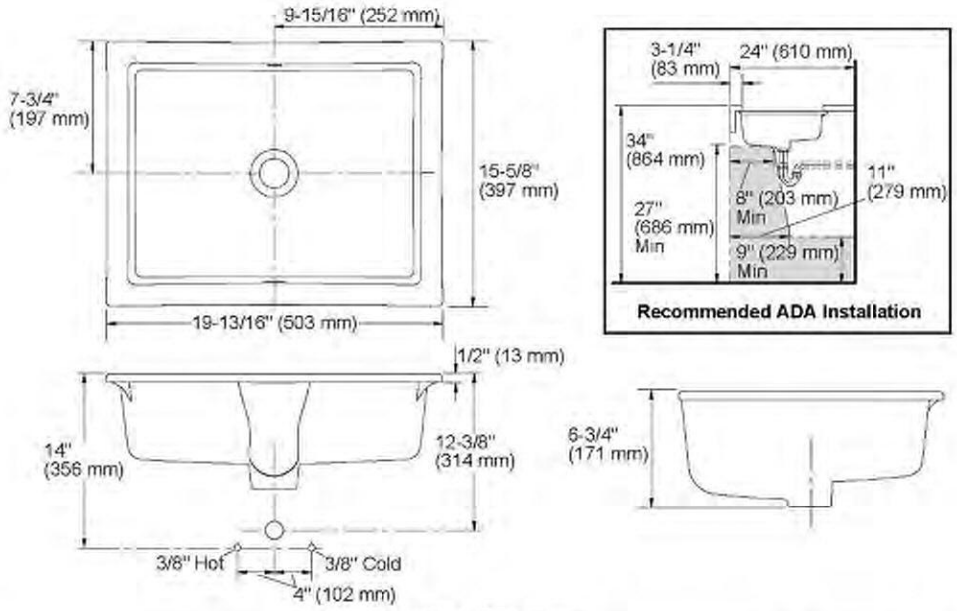
Installation Notes

Install this product according to the installation guide.

NOTICE: Countertop manufacturer or cutter must use the current product template available at www.kohler.com, or by calling 1-800-4KOHLER. Kohler Co. is not responsible for cutout errors when the incorrect cutout template is used.

Will comply with **ADA** when installed per section 606 Lavatories and Sinks of the 2010 ADA Standards for Accessible Design.

For under-mount installation, countertop thickness cannot be greater than 1" (25 mm) for **ADA** compliance.



Product Diagram

THE BOLD LOOK OF KOHLER.

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Guest Baths Only

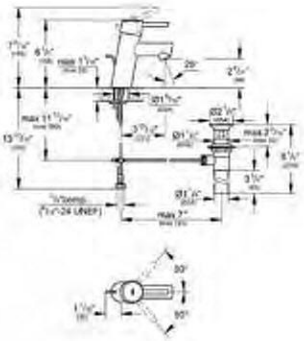
CONCETTO
Lavatory Centerset
S-Size
MODEL # 34270

GROHE America, Inc | 200 North Gary Avenue, Suite G, Roselle, IL 60172
Phone: +1 (800) 444-7643 | Fax: +1 (800) 225-2778 | us-customerservice@grohe.com

Pure Freude an Wasser

GROHE





ADA

Product Description:
Lavatory Centerset
S-Size

Standard Specification:
- **GROHE StarLight®** finish
- **GROHE SilkMove®** ceramic cartridge
- **GROHE EcoJoy®** technology for less water and perfect flow
- **GROHE QuickFix™** installation system with centering support
- Single hole installation
- Metal lever
- Flow control
- 1 1/4" pop-up waste set
- Stainless Steel Braided Flexible Supplies
- Temperature limiter
- Max Flow Rate 1.5 gpm (5.7 L/min)

Applicable Codes & Standards:
- Energy Policy Act of 1992
- NSF 61
- ASME A112.18.1/CSA B125.1
- US Federal and State material regulations
- EPA WaterSense®
- ICC/ANSI A117.1
- CalGreen

Color:
❑ 34270 001 chrome
❑ 34270 EN1 Brushed Nickel inf

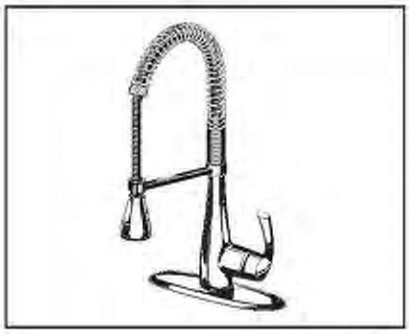
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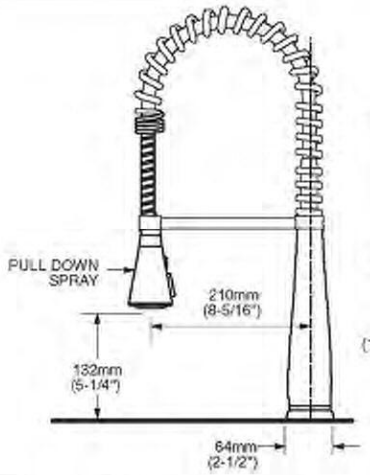
American Standard

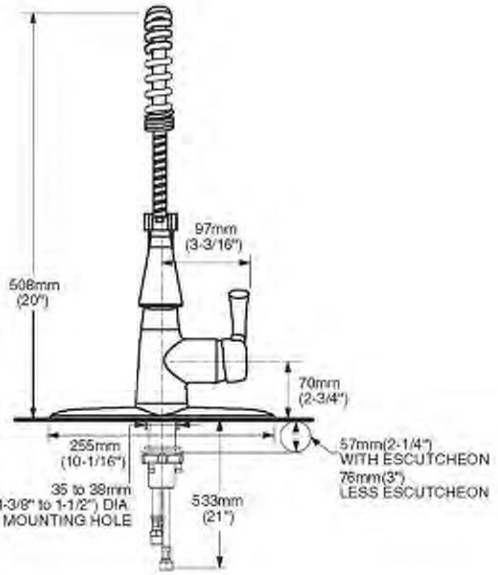
QUINCE™
SEMI-PROFESSIONAL KITCHEN FAUCET



MODEL NUMBER:

- ❑ 4433.350 Semi-Professional Kitchen Faucet
- ❑ 4433.350.F15 Semi-Professional Kitchen Faucet





GENERAL DESCRIPTION:

Metal handle, escutcheon plate and swivel spout (150˚ rotation). Adjustable spray pattern with toggle button activation. Metal reinforced hose with Stainless Steel protector coil. Washerless 40mm ceramic disc valve cartridge. Braided flexible Stainless Steel supply hoses with 3/8" compression connections. Metal mounting shank with brass fixation ring. Complete with two integral check valves. 2.2 gpm/8.3 L/min. maximum flow rate, 1.5 gpm/5.7 L/min. maximum flow rate for F15 models. Fitting can be mounted with or without escutcheon plate (escutcheon size 10-1/16"L x 2-1/2"W).

PRODUCT FEATURES:

Ceramic Disc Valve Cartridge: Assures smooth, precise valve control and a lifetime of drip-free, maintenance-free performance.

Memory Position Valving: Allows user to turn valve on and off at preferred temperature setting without readjusting handle position each time.

Lead Free: Faucet contains ≤ 0.25% total lead content by weighted average.

Integral Check Valves: Prevents back flow.

Toggle Spray Function: Switches water flow from a stream to a spray and includes pause feature.

SUGGESTED SPECIFICATION:

Single control semi-professional kitchen faucet shall feature a metal swivel spout with two check valves, metal escutcheon plate and handle. Shall also feature washerless ceramic disc valve cartridge and flexible Stainless Steel supply hoses. Faucet shall be American Standard Model # 4433.350.____.____.

A13

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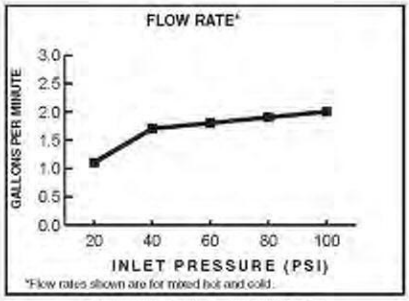
American Standard

QUINCE™
SEMI-PROFESSIONAL KITCHEN FAUCET

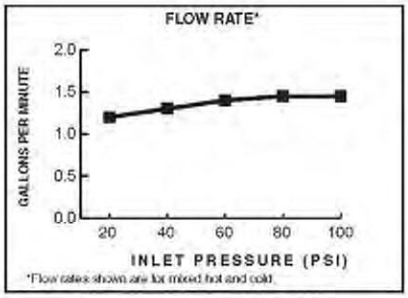
CODES AND STANDARDS

These products meet or exceed the following codes and standards:

ANSI A117.1
ASME A112.18.1
NSF 61/Section 9 & Annex G
CSA B125



2.2 gpm/8.3 L/min. FLOW RATE



1.5 gpm/5.7 L/min. FLOW RATE

Product Number	Description	Finish Options	
		Polished Chrome	PVD Stainless Steel
		002	075
4433.350	Semi-Professional Kitchen Faucet - 2.2 gpm/8.3 L/min. maximum flow rate		
4433.350.F15	Semi-Professional Kitchen Faucet - 1.5 gpm/5.7 L/min. maximum flow rate		

Meets the American Disabilities Act Guidelines and **ANSI A117.1** Requirements for the physically challenged.

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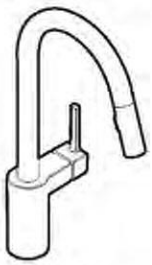
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MOEN

Buy it for looks. Buy it for life.®

Specifications



ALIGN™
Single Handle High Arc Pulldown Kitchen Faucet

Models: 7565 series

NOTE: THIS FAUCET IS DESIGNED TO BE INSTALLED THRU 1 HOLE, 1-1/2" (38mm) MIN. DIA.. (OPTIONAL 3-HOLE ESCUTCHEON 141002 AVAILABLE)

FAUCET DESCRIPTION
- Reflex™ pulldown system offers smooth operation, easy movement and secure docking
- Metal construction with various finishes identified by suffix
- Quick connect installation
- Pulldown spray with 68" braided hose
- Flexible supply lines with 3/8" compression fittings
- High arc spout provides height and reach to fill or clean large pots while pulldown wand provides the maneuverability for cleaning or rinsing
- 360° rotating spout provides ability to install handle on either side
- Faucet designed for handle to be mounted on right side

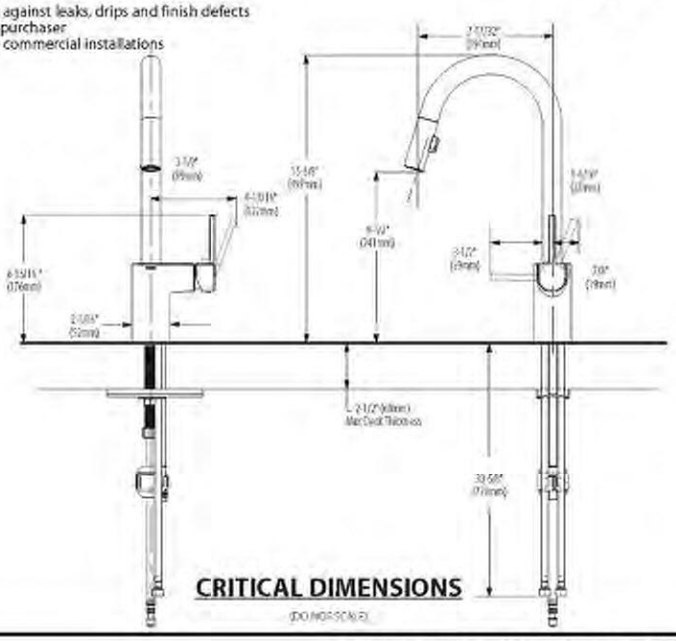
OPERATION
- Lever style handle
- Temperature controlled by 100° arc of handle travel
- Operates with less than 5 lbs. of force
- Operates in stream or spray mode in the pullout or retracted position

FLOW
- Flow is limited to 1.5 gpm (5.7 L/min) max at 60 psi

CARTRIDGE
- 1255™ Duralast™ cartridge

STANDARDS
- Third party certified to IAPMO Green, ASME A112.18.1/CSA B125.1 and all applicable requirements therein including NSF 61/9G
- Meets CalGreen and Georgia SB370 requirements
- Contains no more than 0.25% weighted average lead content
- Complies with California Proposition 65 and with the Federal Safe Drinking Water Act
- The backflow protection system in the device consists of two independently operating check valves, a primary and a secondary which prevent backflow
- **ADA** for lever handle

WARRANTY
- Lifetime limited warranty against leaks, drips and finish defects to the original consumer purchaser
- 5 year warranty if used in commercial installations



CRITICAL DIMENSIONS

(DO NOT SCALE)

5/13

FOR MORE INFORMATION CALL: 1-800-BUY-MOEN
www.moen.com

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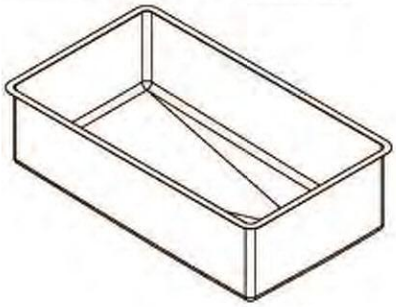
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ELKAY SPECIFICATIONS

Crosstown™ Undermount Single Bowl Sink Model ECTRU30179R



Model ECTRU30179R

GENERAL
Highest quality sink fabricated of #18 (1.2mm) gauge, type 304 (18-8) nickel bearing stainless steel. Undermount.

DESIGN FEATURES
Bowl Depth: 9" (229mm).
Coved Corners: Approximately 5/8" (15mm).
Finish: Exposed surfaces have a Polished Satin Finish.
Underside: Fully protected by heavy duty Sound Guard™ undercoating designed to reduce condensation and dampen sound.

OTHER
Drain Opening: 3-1/2" (89mm).
NOTE: All Elkay undermount sinks are designed to attach to the underside of any solid surface countertop.
Sink complies with ASME A112.19.3/ CSA B45.4

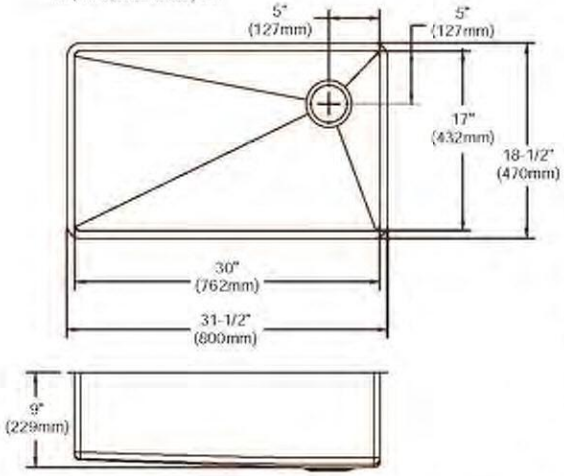
Sinks are listed by IAPMO® as meeting the applicable requirements of the Uniform Plumbing Code®, International Plumbing Code®, and National Plumbing Code of Canada.

OPTIONAL ACCESSORIES
Bottom Grid: GFOBG3017RSS
Cutting Board: LKCBF17HW
Mounting Clips: LKUCLIP8
Rinsing Basket: LKWERBSS
Utensil Caddy for Rinsing Basket: LKWUCSS
Drain: LK35, LK99

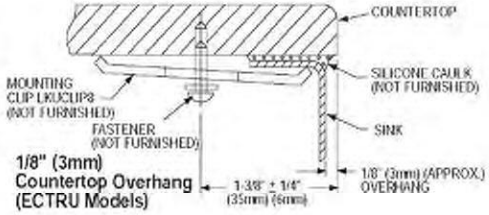
SINK DIMENSIONS*

Model Number	Overall		Inside Bowl			Cutout in Countertop	Minimum Cabinet Size
	L	W	L	W	D		
ECTRU30179R	31 ½" (800mm)	18 ½" (470mm)	30" (762mm)	17" (432mm)	9" (229mm)	See Template**	36" (914mm)

*Length is left to right. Width is front to back.
**Template is packed with every sink.



Installation Profile of ECTRU Models
The template provided with each ECTRU sink provides the only type of installation recommended by Elkay



In keeping with our policy of continuing product improvement, Elkay reserves the right to change product specifications without notice. Please visit elkayusa.com for most current version of Elkay product specification sheets.

This specification describes an Elkay product with design, quality and functional benefits to the user. When making a comparison of other producers' offerings, be certain these features are not overlooked.

Elkay
elkay.com
elkaypro.com

2222 Camden Court
Oak Brook, IL 60523

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Inspections Division
Approved with Conditions
Date: 04/11/17



Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

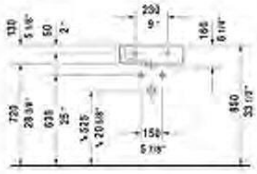
DURAVIT

Furniture handrinse basin # 070445

|< 17 3/4" Inch >|







Furniture handrinse basin	Dimension	Weight	Order number
with overflow, with tap platform, cUPC listed, fixings included, 17 3/4" Inch			
Colors			
00 White 08 Black			
Variant			
Sanitary ceramics with the special WonderGliss surface finish will remain clean and attractive-looking for a long time to come. When ordering WonderGliss please add a "1" as eleventh digit to the model number.			
Space-saving siphon			005073
Suitable products			
Vanity unit wall-mounted 1 door, for Vero # 070445 (not ground), 15 3/4" x 12 5/8" Inch	15 3/4" x 12 5/8" Inch		KT6630 L/R
Vanity unit wall-mounted 1 door, for Vero # 070445 (not ground), 15 3/4" x 13" Inch	15 3/4" x 13" Inch		XL6209 L/R
Vanity unit wall-mounted 1 door, for Vero # 070445 (not ground), 15 3/4" x 12 1/4" Inch	15 3/4" x 12 1/4" Inch		VE6271 L/R

All drawings contain the necessary measurements which are subject to standard tolerances. They are stated in inch & mm and are non-binding. Exact measurements, in particular for customized installation scenarios, can only be taken from the finished ceramic piece.

62 India Street

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

Powder and Master Bathroom Faucets

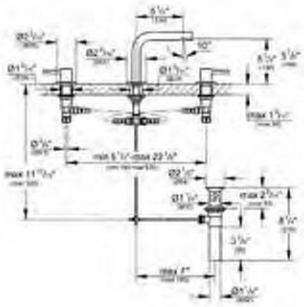
ESSENCE
Three-hole basin mixer 1/2" S-Size
MODEL # 20297

Pure Freude an Wasser

GROHE

GROHE America, Inc | 200 North Gary Avenue, Suite G, Roselle, IL 60172
Phone: +1 (800) 444-7643 | Fax: +1 (800) 225-2778 | us-customerservice@grohe.com





ADA

Product Description:
Three-hole basin mixer 1/2"
S-Size

Standard Specification:
- **GROHE StarLight®** finish
- **GROHE EcoJoy®** technology for less water and perfect flow
- Tubular spout
- Integrated flow control
- 3/4" ceramic cartridges (90° turn)
- 1 1/4" pop-up waste set
- Quick installation system
- Union nut with 7/16" drilling
- Pressure resistant flexible connection hoses (between spout and side valves)
- Max Flow Rate 1.5 gpm at 60 psi (5.7 L/min)

Applicable Codes & Standards:
- Energy Policy Act of 1992
- NSF 61
- ASME A112.18.1/CSA B125.1
- US Federal and State material regulations
- EPA WaterSense®
- ICC/ANSI A117.1

Color:
❑ 20297 000 chrome
❑ 20297 EN0 Brushed Nickel

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17



Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

SECTION 260000 - GENERAL ELECTRICAL REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Basic Electrical Requirements specifically applicable to Divisions 26, 27 and 28 Sections.

1.02 REFERENCES

A. ANSI/NFPA 70 - National Electrical Code.

B. ANSI C2 - National Electrical Safety Code.

C. ANSI/NFPA 101 - Life Safety Code.

1.03 RELATED REQUIREMENTS

A. Conditions of the Contract and Division 1 - General Requirements, apply to all work, including work of this Division. Examine all contract documents for requirements affecting this work.

1.04 SUBMITTALS

A. Submit under provisions of Division 01.

B. Submit shop drawings and product data grouped to include complete submittals of related systems, products, and accessories in a single submittal.

C. Mark dimensions and values in units to match those specified.

D. Provide fixture schedule, lighting drawings, panelboard schedules and single line or risers diagram(s) to supplier for assistance in pricing as applicable. Contractor shall receive one set of black line drawings for reproduction from the engineer for this purpose.

1.05 REGULATORY REQUIREMENTS

A. Conform to applicable local, State and Federal Building Code for the State of Maine.

B. Electrical: Conform to NFPA 70, NFPA72, NFPA 99, NFPA 101, ANSI C2, 2 FM, UL, and applicable ASTM and ANSI Standards.

C. Contractor shall visit the site to become familiar with all existing conditions affecting this work. No claim shall be recognized for extra compensation due to failure of contractor to familiarize himself/herself with the conditions and extent of proposed work.

D. Obtain permits and request inspections by local authority having jurisdiction.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1.06 PROJECT/SITE CONDITIONS

A. Install Work in locations shown on Drawings, unless prevented by Project conditions.

B. Prepare drawings showing proposed rearrangement of Work to meet Project conditions, including changes to Work specified in other Sections. Obtain permission of Engineer before proceeding.

1.08 TEMPORARY LIGHT AND POWER

A. Temporary light and power shall be installed and maintained by the Electrical Contractor for use by all trades for the duration of construction complete with all wiring, switches, protective devices and similar equipment as may be required. Arrangement for the temporary service with the Power Company is the responsibility of the Electrical Contractor. Power bills will be paid by the General Contractor. Provide 120/208 volt or 120/240 volt 100 ampere, drop box similar to standard CMP detail 980-31.1.4. Provide 15-20 watt self ballasted compact fluorescent, lamps with plastic “cages” as needed. or 4 foot twin lamp (T8) fluorescent tamper-proof, gasketted and water-tight as required.

1.09 CONTRACT DRAWINGS AND SPECIFICATIONS

A. It is to be understood that drawings accompanying these specifications are intended to show general arrangement and extent of work to be done, but exact location and arrangement of all components shall be determined as work progresses. Anything shown on the drawings and not specifically mentioned in specifications or vice versa shall be considered as required in both.

B. Locations of equipment, and materials, etc., as given on drawings are approximate unless dimensioned. It shall be understood they are subject to such modifications as may be found necessary or desirable at time of installation in order to meet any structural conditions. Such changes shall be made by the contractor without extra charges.

C. Because of small scale drawings, all required offsets, etc., as may be required to clear work of other Contractors, may not be shown. Contractor, however, shall provide all necessary offsets, etc., as required to complete the installation of their work and not conflict with that of others.

D. It is the intention that wiring systems shall be complete and fully operational. The contractor shall identify system components during the bid process that clearly constitute conditions that would cause the system to be incomplete. Clarification: The remedy to these discrepancies shall be communicated by the engineer to all bidders or included as an addenda.

1.10 MATERIALS AND LABOR

A. Bidders for this work shall carefully examine the Plans and Specifications, as the Contractor shall be required to furnish all materials and labor necessary to deliver to the Owner a complete system installed in full accordance with Local State and Federal laws. The system shall be furnished as specified, tested, and turned over to the Owner in perfect operating condition.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

B. All materials shall be new and of best quality of their respective kinds. Workmanship in al respects shall be of highest grade and all construction shall be done according to best practices of the trade. Materials shall be warrantied directly by the manufacturer.

C. Contractor shall provide, when required for review of Engineer, labeled samples of any material or equipment specified herein or proposed to be used on this project.

D. Where words "furnish", "provide" or "install" are mentioned, either singly or in combination, these words are hereby interpreted to mean "furnish and install" or "provide and install," including all materials complete with all connections, supplemental devices, accessories and appurtenances, unless specifically otherwise noted. These words are likewise hereby interpreted as being prefixed to all materials, equipment, and apparatus hereinafter mentioned, either in abbreviated or schedule information.

1.11 PROTECTION OF WORK AND MATERIALS

A. Contractors shall be responsible for the care and protection of all materials delivered and labor performed until the completion of the work.

B. Cap all uncompleted lines, raceways, and ducts until ready for final connections, or future work as indicated.

C. All portions of the work liable to damage by weather or by those engaged on the project, must be securely protected by temporary, but substantial covering which must be maintained in position until Engineer authorizes removal.

1.12 REPLACEMENTS

A. In the event of damage to any equipment or materials, immediately make all repairs and replacements necessary to the approval of the Engineer at no additional cost to the Owner.

1.13 SAFETY REGULATIONS

A. All work to be performed and/or installed shall conform to all requirements of the Occupational Safety and Health Act (OSHA) of 1970 and all Amendments thereto.

1.14 QUALITY ASSURANCE/CONTROL OF INSTALLATION

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

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

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

D. 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.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

E. Perform work using persons qualified to produce workmanship of specified quality.

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

1.15 SCHEDULE OF MATERIALS AND EQUIPMENT

A. As soon as practicable, and before commencement of installation of any material or equipment, a complete schedule of materials and equipment proposed for installation shall be submitted for review. Schedule shall also include a list of all proposed subcontractors. Partial or incomplete lists will not be considered. Any materials, fixtures, and equipment not conforming to specifications may be rejected. Also see Section 01300, Submittals.

B. Orders for purchase of any devices, material, conduit, etc., or other equipment shall not be placed until this schedule is reviewed.

1.16 UNDERWRITER'S APPROVALS

A. All electrical materials and equipment shall bear label of Underwriter's Laboratories, shall be listed by them in their list of electrical fittings and shall be approved by them for purpose for which they are to be used, unless materials and equipment are of a type for which Underwriter's Laboratories does not list or provide label service.

1.17 RECORD DRAWINGS

A. During construction, the Contractor shall keep an accurate record of all deviations to the installation of the work as indicated on the drawings. Upon completion of the work, the Contractor shall furnish a copy of this record to the Engineer, on a black line of the original which will be available from the Engineer. Submit record drawings before requesting final payment.

1.18 MANUFACTURER'S REPRESENTATIVE

A. At appropriate times, or as directed by the Engineer, provide the services of a competent factory trained Engineer or Technician of the particular manufacturer of equipment or item involved, to inspect, adjust, and place in proper operating condition any and all such items of manufacture. No additional compensation shall be allowed Contractors for such service.

1.19 MANUFACTURERS' INSTRUCTIONS, AND OPERATION AND MAINTENANCE DATA

A. Provide for each item of equipment or apparatus furnished, a complete set of printed instructions obtained from the manufacturer covering proper operation, care, lubrication, cleaning, servicing, adjustment, etc., together with any special safety instructions.

B. Manufacturers' data shall further include performance data (time current curves, where applicable), complete parts lists, recommended spare parts lists, and wiring diagrams.

C. Data shall be arranged in complete sets, properly indexed and marked.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

D. Data shall include complete set of shop drawings.

E. Material shall first be submitted in preliminary fashion for review by Engineer. After approval, Contractor shall submit two (2) copies in bound volumes to the Engineer for distribution.

F. Provide contacts for service agencies for all major system components.

1.20 GUARANTEES

A. An item becomes "defective" when it ceases to conform to this Contract Document. Guarantees beginning on the date of issuance of the Owner's final payment, or certificate of substantial completion, with Owner taking occupancy or beneficial use thereafter.

B. Upon completion of the work and before applying for final payment, furnish a written guarantee, stating that the work complies with the provisions of codes listed herein and the local enforcing authorities, and that it will be free from defects of material and workmanship for the required guarantee period. Guarantee shall further state that the Contractor will, at his own expense, repair and/or replace any of his material and work which may become defective during the time of guarantee, together with other work damaged as a consequence of such defects. All manufacturers written warranties shall apply to materials. Warranties other than that of the manufacturer are not acceptable.

C. The guarantee period shall be one (1) year except when longer periods are indicated for specific equipment.

D. All materials in Division 26 where a written warranty is published shall require the warranty to be offered by the product manufacturer.

1.21 EXISTING UTILITIES AND EQUIPMENT

A. Extreme care shall be taken to protect existing utilities and equipment above and below grade and in all other locations. Information contained on drawings is not guaranteed as to location, invert, etc. but represent the best information available as to the location of underground and concealed utilities and equipment. The Contractor shall be responsible for the replacement of all damaged or broken utilities or equipment due to their work or operations.

1.22 ENERGIZING EQUIPMENT

A. Obtain Owner’s written approval before energizing any equipment.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.01 CONNECTION TO EQUIPMENT

A The Contractor shall be responsible for proper wiring and raceway connections to equipment,

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

make sure of alignment, both initially and under operating conditions, and provide proper supports, brackets, means of expansion, etc., to make sure that no excessive stresses are applied to equipment. Raceways shall be run to the equipment and alignment checked before final bolting and fastening.

B At the request of the Engineer, dismantle equipment connections to demonstrate proper installation and make such corrections necessary without additional compensation for disassembly, re-connection, or the required corrective work.

C Equipment shall be installed in such a manner as to permit disconnecting for service and repairs without the necessity of rigging.

3.02 CLOSING IN UNINSPECTED WORK

A General: Do not cover up or enclose work until it has been properly and completely inspected and approved. Engineer may waive this requirement by written permission.

B Noncompliance: Should any of the work be covered up or enclosed prior to all required inspections and approvals, uncover the work as required, and after it has been completely inspected and approved, make all repairs and replacements with such materials as are necessary to the approval of the Engineer and at no additional cost to the Owner.

3.03 CLEANING OF SYSTEMS

A All wiring systems shall be thoroughly cleaned prior to initial operation and in accordance with manufacturer's instructions for equipment to be furnished and/or installed.

B Furnish all detergents, solvents, cleaning compounds, tools, etc., required in connection with cleaning operations.

C Thoroughly clean all exposed portions of all equipment, remove all labels, and wipe clean with a damp rag.

3.04 TESTING, BALANCING, AND ADJUSTING

A Electrical loads shall be balanced on all phase legs to a tolerance of plus or minus 10 percent. Include testing circuits for shorts to ground. Measure grounding system resistance. Correct all deficiencies. Provide all test equipment.

3.05 INSTRUCTIONS

A On completion of the job, Contractor shall provide competent technicians to thoroughly instruct the Owner's representative in the care and operation of the system. The total period of instruction shall not exceed 2 hours and be performed in a minimum of one interval. The time of instruction shall be arranged with the Owner. The Electrical subcontractor shall be present and participate in the Owner’s instruction.

3.06 FIRESTOPPING

A Firestopping shall be performed in accordance with Specification Section “Firestopping”. All

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

penetrations of fire-rated assemblies including walls and floors by electrical system components (conduits, cables, etc.) shall be firestopped as specified. Coordinate size, location and type of sleeves as required by firestopping systems.

*** END OF SECTION ***

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Aluminum and Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.

B. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN-2-THWN-2 and Type SO.

C. Multiconductor Cable: Comply with NEMA WC 70/ICEA S-95-658 for nonmetallic-sheathed cable, Type NM with ground wire and metal-clad cable, Type MC and service entrance cable, type SE.

2.2 CONNECTORS AND SPLICES

A. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

B. Comply with NFPA 70.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Conductor sizes and quantities shown on drawings are for copper.

B. Minimum branch circuit conductor size; 12 AWG

C. Feeders: Copper for feeders smaller than No. 4 AWG; copper or aluminum for feeders No. 4 AWG and larger. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

D. Branch Circuits (residential areas): Copper. Solid for No. 12 AWG; stranded for No. 10 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type THHN-2-THWN-2, single conductors in raceway.

B. Exposed Feeders: Type THHN-2-THWN-2, single conductors in raceway.

C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN-2-THWN-2, single conductors in raceway or Service Entrance Cable, type SE.

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-2-THWN-2, single conductors in raceway.

E. Exposed Branch Circuits: Type THHN-2-THWN-2, single conductors in raceway.

F. Branch Circuits (Residential spaces) Concealed in Ceilings, Walls, and Partitions: Nonmetallic-sheathed cable, Type NM.

G. Branch Circuits (Non-Residential spaces) Concealed in Ceilings, Walls, and Partitions: metal-clad cable, Type MC.

H. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-2-THWN-2, single conductors in raceway.

I. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.

C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway.

E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

B. Make splices, terminations, and taps that are compatible with conductor material**.**

1. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches (150 mm) of slack.

3.5 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating.

END OF SECTION 260519

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Grounding systems and equipment.

B. Section includes grounding systems and equipment, plus the following special applications:

1. Ground bonding common with lightning protection system.
2. Underground distribution grounding.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. Insulated Conductors: Copper or tinned-copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

C. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches (6.3 by 100 mm) in cross section, with 9/32-inch (7.14-mm) holes spaced 1-1/8 inches (28 mm) apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V. Lexan or PVC, impulse tested at 5000 V.

2.2 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, pressure type with at least two bolts.

1. Pipe Connectors: Clamp type, sized for pipe.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

D. Bus-bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

2.3 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel; 3/4 inch by 10 feet.

1. Termination: Factory-attached No. 4/0 AWG bare conductor at least 48 inches (1200 mm) long.
2. Backfill Material: Electrode manufacturer's recommended material.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

B. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 2/0 AWG minimum.

1. Bury at least 24 inches (600 mm) below grade.
2. Duct-Bank Grounding Conductor: Bury 12 inches (300 mm) above duct bank when indicated as part of duct-bank installation.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

C. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing serv equipment, and elsewhere as indicated.

1. Install bus on insulated spacers 2 inches (50 mm) minimum from wall, 6 inches (150 mm) above finished floor unless otherwise indicated.
2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down to specified height above floor; connect to horizontal bus.

D. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

3.2 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

A. Comply with IEEE C2 grounding requirements.

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

C. Metal Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

3.4 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Rods: Drive rods until tops are 2 inches (50 mm) below finished floor or final grade unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetr any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

D. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

E. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.

3.5 LABELING

A. Comply with requirements in Section 260553 "Identification for Electrical Systems" for instruction signs. The label or its text shall be green.

3.6 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.

C. Grounding system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

E. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.

F. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 260526

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

SECTION 260533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Metal conduits, tubing, and fittings.
2. Nonmetal conduits, tubing, and fittings.
3. Boxes, enclosures, and cabinets.

1.3 DEFINITIONS

A. GRC: Galvanized rigid steel conduit.

1.4 ACTION SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

A. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. GRC: Comply with ANSI C80.1 and UL 6.

C. FMC: Comply with UL 1; zinc-coated steel or aluminum.

D. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

E. Fittings for Conduit: Comply with NEMA FB 1 and UL 514B.

1. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions were installed, and including flexible external bonding jumper.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

F. Joint Compound for GRC: Approved, as defined in NFPA 70, by authorities having jurisdict for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

A. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.

C. Fittings for RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

D. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. Solvent cements and adhesive primers shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.3 BOXES, ENCLOSURES, AND CABINETS

A. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

B. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.

C. Device Box Dimensions: 4 inches square by 2-1/8 inches deep (100 mm square by 60 mm deep).

D. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 3R with continuous-hinge cover with flush latch unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: GRC.
2. Concealed Conduit, Aboveground: GRC.
3. Underground Conduit: RNC, Type EPC-40-PVC.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneuma Electric Solenoid, or Motor-Driven Equipment): FMC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Indoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed: RNC, Type EPC-40-PVC.
2. Concealed in Ceilings and Interior Walls and Partitions: RNC, Type EPC-40-PVC.
3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FNMC, except use LFNMC in damp or wet locations.
4. Damp or Wet Locations: RNC, Type EPC-40-PVC.
5. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in damp or wet locations.

C. Minimum Raceway Size: 3/4-inch (21-mm) trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

3.2 INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

B. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Arrange stub-ups so curved portions of bends are not visible above finished slab.

E. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches (300 mm) of changes in direction.

F. Support conduit within 12 inches (300 mm) of enclosures to which attached.

G. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot (3-m) intervals.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

2. Arrange raceways to cross building expansion joints at right angles with expans fittings.
3. Arrange raceways to keep a minimum of 1 inch (25 mm) of concrete cover in all directions.
4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.

H. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

I. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

J. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch (35mm) trade size and insulated throat metal bushings on 1-1/2-inch (41-mm) trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

K. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

L. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

M. Cut conduit perpendicular to the length. For conduits 2-inch (53-mm) trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.

N. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

O. Expansion-Joint Fittings:

1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F (17 deg C) and that has straight-run length that exceeds 25 feet (7.6 m). Install in each run of aboveground RMC conduit that is located where environmental temperature change may exceed 100 deg F (55 deg C) and that has straight-run length that exceeds 100 feet (30 m).
2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:

    a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F (70 deg C) temperature change.
    b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F (86 deg C) temperature change.
    c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F (70 deg C) temperature change.
    d. Attics: 135 deg F (75 deg C) temperature change.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per f of length of straight run per deg F (0.06 mm per meter of length of straight run per deg C) of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F (0.0115 mm per meter of length of straight run per deg C) of temperature change for metal conduits.
4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

P. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches (1830 mm) of flexible conduit for equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.

Q. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

R. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

S. Locate boxes so that cover or plate will not span different building finishes.

T. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

U. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

3.3 INSTALLATION OF ELECTRICAL BOXES IN FIRE RATED WALLS

A. Outlet boxes on opposite sides of the wall shall be separated as follows:

1. By a horizontal distance of not less than 24 inches (610 mm);

2. By a horizontal distance of not less than the depth of the wall cavity where the wall cavity is filled with cellulose loose fill, rockwool or slag mineral wool insulation.

3. By protecting both outlet boxes by listed putty pads, 3M Catalog # MPP+ or equal.

B. Boxes exceeding 16 sq. in. (103 sq. cm) must be protected by listed putty pads, 3M Catalog # MPP+ or equal.

3.4 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trer bottom as specified in Civil sections for pipe less than 6 inches (150 mm) in nominal diameter.
2. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches (300 mm) of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Civil sections"
3. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
4. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.

    a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete for a minimum of 12 inches (300 mm) on each side of the coupling.
    b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches (1500 mm) from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.

END OF SECTION 260533

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Identification for raceways.
2. Identification of power and control cables.
3. Identification for conductors.
4. Underground-line warning tape.
5. Warning labels and signs.
6. Instruction signs.
7. Equipment identification labels.
8. Miscellaneous identification products.

1.3 ACTION SUBMITTALS

A. Product Data: For each electrical identification product indicated.

1.4 QUALITY ASSURANCE

A. Comply with ANSI A13.1.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.5 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

B. Coordinate installation of identifying devices with completion of covering and painting surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 POWER AND CONTROL RACEWAY IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.

B. Colors for Raceways Carrying Circuits at 600 V or Less:

1. Black letters on an white field.
2. Legend: Indicate voltage.

C. Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing ends of legend label.

D. Snap-Around Labels for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

E. Snap-Around, Color-Coding Bands for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

F. Tape and Stencil for Raceways Carrying Circuits More Than 600 V: 4-inch- (100-mm-) wide black stripes on 10-inch (250-mm) centers diagonally over orange background that extends full length of raceway or duct and is 12 inches (300 mm) wide. Stop stripes at legends.

2.2 ARMORED AND METAL-CLAD CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each cable size.

B. Colors for Cables Carrying Circuits at 600 V and Less:

1. Black letters on an white field.
2. Legend: Indicate voltage.

C. Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing ends of legend label.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

D. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches (50 m wide; compounded for outdoor use.

E. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tube with machine-printed identification label. Sized to suit diameter of and shrinks to fit firmly around cable it identifies. Full shrink recovery at a maximum of 200 deg F (93 deg C). Comply with UL 224.

2.3 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each cable size.

B. Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing ends of legend label.

C. Self-Adhesive, Self-Laminating Polyester Labels: Preprinted, 3-mil- (0.08-mm-) thick flexible label with acrylic pressure-sensitive adhesive that provides a clear, weather- and chemical-resistant, self-laminating, protective shield over the legend. Labels sized to fit the cable diameter such that the clear shield overlaps the entire printed legend.

D. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tube with machine-printed identification label. Sized to suit diameter of and shrinks to fit firmly around cable it identifies. Full shrink recovery at a maximum of 200 deg F (93 deg C). Comply with UL 224.

2.4 UNDERGROUND-LINE WARNING TAPE

A. Tape:

1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
2. Printing on tape shall be permanent and shall not be damaged by burial operations.
3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.

B. Color and Printing:

1. Comply with ANSI Z535.1 through ANSI Z535.5.
2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE.
3. Inscriptions for Orange-Colored Tapes: TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE.

2.5 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

C. Baked-Enamel Warning Signs:

1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
2. 1/4-inch (6.4-mm) grommets in corners for mounting.
3. Nominal size, 7 by 10 inches (180 by 250 mm).

D. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 MM)."

2.6 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch (1.6 mm) thick for signs up to 20 sq. inches (129 sq. cm) and 1/8 inch (3.2 mm) thick for larger sizes.

1. Engraved legend with black letters on white face.
2. Punched or drilled for mechanical fasteners.
3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

B. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm).

2.7 EQUIPMENT IDENTIFICATION LABELS

A. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm).

B. Self-Adhesive, Engraved, Laminated Acrylic: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).

C. Engraved, Laminated Acrylic: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).

2.8 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

PART 3 - EXECUTION

3.1 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

E. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches (150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench exceeds 16 inches (400 mm) overall.

3.2 IDENTIFICATION SCHEDULE

A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A, and 120 V to ground: Identify with self-adhesive vinyl label. Install labels at 30-foot (10-m) maximum intervals.

B. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.

1. Color-Coding for Phase Identification, 600 V or Less: Use colors listed below for ungrounded feeder and service conductors.

a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
b. Colors for 208/120-V Circuits:

1) Phase A: Black.
2) Phase B: Red.
3) Phase C: Blue.

C. Install instructional sign including the color code for grounded and ungrounded conductors using adhesive-film-type labels.

D. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, and handholes, use self-adhesive vinyl labels with the conductor or cable designation, origin, and destination.

E. Control-Circuit Conductor Termination Identification: For identification at terminations provide self-adhesive vinyl labels with the conductor designation.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

F. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, cont and signal connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.

G. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring.

1. Install underground-line warning tape for both direct-buried cables and cables in raceway.

H. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.

1. Comply with 29 CFR 1910.145.
2. Identify system voltage with black letters on an orange background.
3. Apply to exterior of door, cover, or other access.
4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:

    a. Power transfer switches.
    b. Controls with external control power connections.

I. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

J. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:

    a. Indoor Equipment: Self-adhesive, engraved, laminated acrylic label. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high.
    b. Outdoor Equipment: Engraved, laminated acrylic label.
    c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
    d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

2. Equipment to Be Labeled:

   a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be self-adhesive, engraved, laminated acrylic label.
   b. Enclosures and electrical cabinets.
   c. Access doors and panels for concealed electrical items.
   d. Enclosed switches.
   e. Enclosed circuit breakers.
   f. Enclosed controllers.
   g. Variable-speed controllers.
   h. Push-button stations.
   i. Contactors.
   j. Remote-controlled switches, dimmer modules, and control devices.

END OF SECTION 260553

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

SECTION 260924 - LIGHTING CONTROL DEVICES

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Wall box mounted, wall/corner mounted, and ceiling mounted occupancy sensors including dual technology, ultrasonic, and passive infrared technologies. This includes self contained PIR sensors as well as low voltage sensors that work with Switchpacks.

B. Related Sections:
   1. Section 265100 – Interior Lighting.

1.2 REFERENCES

A. American National Standards Institute/Institute of Electrical and Electronic Engineers (ANSI/IEEE)
   1. C62.41-1991 – Recommended Practice for Surge Voltages in Low Voltage AC Power Circuits.

B. ASTM International (ASTM)
   1. D4674 -02a Standard Test Method for Accelerated Testing for Color Stability of Plastics Exposed to Indoor Fluorescent Lighting and Window-Filtered Daylight.

C. National Electrical Manufacturers Association (NEMA)
   1. WD1 (R2005) - General Color Requirements for Wiring Devices.

D. Underwriters Laboratories, Inc. (UL):
   1. 94 – Flammability Rating
   2. 916 – Energy Management Equipment.
   3. 508 (2005) - Standard for Industrial Control Equipment.
   4. 244A – Appliance Controls

1.3 SYSTEM DESCRIPTION

A. Permanently installed
   1. Wall switch occupancy sensors
   2. Ceiling mounted occupancy sensors

1.4 SUBMITTALS

A. Submit under provisions of Section 013300.

B. Specification Conformance Document: Indicate whether the submitted equipment:
   1. Meets specification exactly as stated.
   2. Meets specification via an alternate means and indicate the specific methodology used.

C. Shop Drawings; include:
   1. Load schedule indicating actual connected load, load type, and voltage per circuit, circuits and their respective control zones, circuits that are on emergency, and capacity, phase, and corresponding circuit numbers.
   2. Schematic of system.
   3. Lighting plan clearly marking product type, location and orientation of each sensor.

D. Product Data: Catalog specification sheets with performance specifications demonstrating compliance with specified requirements.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1.5 QUALITY ASSURANCE

A. Manufacturer: Minimum 20 years' experience in manufacture of occupancy sensor lighting controls.

B. Manufacturer's Quality System: Registered to ISO 9001:2000 Quality Standards, including in-house engineering for product design activities.

C. Occupancy Sensing Lighting Controls:

1. Listed by UL specifically for the required loads. Provide evidence of compliance upon request.

D. Installer Qualifications: Installer shall be one who is experienced in performing the work of this section, and who has specialized in installation of work similar to that required for this project.

E. Source Limitations: To assure compatibility, obtain occupancy sensors from a single source with complete responsibility over all lighting controls, including accessory products. The use of subcontracted component assemblers is not acceptable.

1.6 PROJECT CONDITIONS

A. Do not install equipment until following conditions can be maintained in spaces to receive equipment:

1. Ambient temperature: 0° to 40° C (32° to 104° F).
2. Relative humidity: Maximum 90 percent, non-condensing.
3. Occupancy Sensors must be protected from dust during installation.

1.7 WARRANTY

A. Provide manufacturer's 5-year parts warranty.

1.8 MAINTENANCE

A. Make ordering of new equipment for expansions, replacements, and spare parts available to end user.

B. Make new replacement parts available for minimum of ten years from date of manufacture.

C. Provide factory direct technical support.

PART 2- PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Eaton Lighting Systems (formerly Cooper Controls)

B. Substitutions: Allowed under provisions of Division 1.

2.2 SENSOR PERFORMANCE REQUIREMENTS

A. Sensing mechanism:

1. Infrared: Utilize multiple segmented lens, with internal grooves to eliminate dust and residue build-up.
2. Dual technology:
   a. Utilize multiple segmented lens, with internal grooves to eliminate dust and residue build-up.
   b. Utilize an operating frequency of 32 kHz or 40 kHz that shall be crystal controlled to operate within plus or minus 0.005% tolerance.
   c. Incorporate Doppler shift ultrasonic and passive infrared motion detection technologies. Products that react to noise or ambient sound shall not be considered.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

B. Power failure memory:
   1. Controls incorporate non-volatile memory. Should power be interrupted and subsequently restored, settings and parameters saved in protected memory shall not be lost.

C. Designed and tested to withstand discharges without impairment of performance when subjected to discharges of 15,000 volts per IEC 801-2.

D. Products tested in identical manner, complaint to NEMA WD 7 -2011 Occupancy Motion Sensors Standards.

E. Sensor shall have time delays from 10 to 30 min.

F. When specified, sensors shall automatically adjust time delay and sensitivity settings.

G. All sensors shall provide an LED as a visual means of indication at all times to verify that motion is being detected during both testing and normal operation.

H. All sensors shall have readily accessible, user adjustable settings for time delay and sensitivity. Settings shall be located on the sensor (not the control unit) and shall be recessed to limit tampering.

I. Where specified, sensor shall have an internal additional isolated relay with Normally Open, Normally Closed, and Common outputs for use with HVAC control, Data Logging and other control options. Sensors utilizing separate components or specially modified units to achieve this function are not acceptable.

2.3 LINE VOLTAGE CEILING MOUNTED OCCUPANCY SENSORS

A. Product: OAC-DT-2000-MV, OAC-DT-2000-DMV

B. Provide all necessary mounting hardware and instructions.

C. Capable of detection of occupancy at desktop level up to 300 square feet, and gross motion up to 1000 square feet

D. Shall accommodate loads from 0-800 watts at 120 volts; 0 to 1200 watts at 277 volts and shall have 180 degree coverage capability.

E. Shall be able to have their visible plastic parts replaced, for color changes in the field, without removing the body of the control from the wall and without requiring special tools.

F. Shall utilize Zero Crossing Circuitry which increases relay life, protects from the effects of inrush current, and increases sensor's longevity.

G. Shall have no leakage current to load, in manual or in Auto/Off Mode for safety purposes and shall have voltage drop protection.

H. Where specified, dual relay sensors shall offer daylighting foot-candle adjustment control for either or both relays.

2.4 OCCUPANCY WALL SWITCHES

A. Product: OSW-P-0451-MV-*, ONW-P-1001-MV-*, ONW-P-1001-347-*, ONW-P-1001-DMV-*, ONW-P-1001-D347-*, ONW-P-1001-SP-*, ONW-P-1001-RR7-*

B. Capable of detection of occupancy at desktop level up to 300 square feet, and gross motion up to 1000 square feet

C. Shall accommodate loads from 0-800 watts at 120 volts; 0 to 1200 watts at 277 volts and shall have 180 degree coverage capability.

D. Shall be able to have their visible plastic parts replaced, for color changes in the field, without removing the body of the control from the wall and without requiring special tools.

E. Shall utilize Zero Crossing Circuitry which increases relay life, protects from the effects of inrush current, and increases sensor's longevity.

F. Shall have no leakage current to load, in manual or in Auto/Off Mode for safety purposes and shall have voltage drop protection.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

G. Where specified, wall switch sensors shall provide a field selectable option to convert sensor operation from Automatic On to Manual On.

H. Where specified, dual relay sensors shall offer daylighting footcandle adjustment control for either or both relays.

2.5 SOURCE QUALITY CONTROL

A. Perform full-function testing on 100% of all system components and panel assemblies at the factory.

PART 3- EXECUTION

3.1 INSTALLATION

A. Install equipment in accordance with manufacturer's installation instructions.

B. Provide complete installation of system in accordance with Contract Documents.

C. Provide equipment at locations and in quantities indicated on Drawings. Provide any additional equipment required to provide control intent.

3.2 TESTING

A. Upon completion of all wiring and after all fixtures are installed and lamped, a representative shall check the installation prior to energizing the system. Each installed occupancy sensor shall be tested in the Test Mode to see that lights turn OFF and on based on occupancy.

B. At the time testing, the owner's representative shall be thoroughly instructed in the proper operation of the system.

END OF SECTION

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

SECTION 261900 - SUPPORTING DEVICES

PART 1 GENERAL

1.01 WORK INCLUDED

A. Conduit and equipment supports.

B. Fastening hardware.

1.02 RELATED WORK

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

PART 2 PRODUCTS

2.01 MATERIAL

A. Support Channel: Galvanized or painted steel.

B. Hardware: Corrosion resistant.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install products in accordance with manufacturer’s instructions.

B. Fasten hanger rods, conduit clamps, and outlet and junction boxes to building structure using pre-cast insert system, expansion anchors, beam clamps.

C. Anchors and Fasteners

1) Concrete Structural Elements: Use pre-cast insert system, expansion anchors, powder actuated anchors and preset inserts.
2) Steel Structural Elements: Use beam clamps, steel ramset fasteners, and welded fasteners.
3) Concrete Surfaces: Use self-drilling anchors and expansion anchors.
4) Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts and hollow wall fasteners.
5) Solid Masonry Walls: Use expansion anchors and preset inserts.
6) Sheet Metal: Use sheet metal screws.
7) Wood Elements: Use wood screws.

D. Do not fasten supports to piping, ductwork, mechanical equipment, or conduit.

E. Do not use power-actuated anchors.

F. Do not drill structural steel members.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

G. Fabricate supports or trapeze hangers from structural steel or steel channel, rigidly welded bolted to present a neat appearance. Use hexagon head bolts with spring lock washers under all nuts.

H. In wet locations install free-standing electrical equipment on concrete pads.

I. Install surface-mounted cabinets and panelboards with minimum of four anchors. Provide steel channel supports to stand cabinet one inch off wall.

*** END OF SECTION ***

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Distribution panelboards.
2. Load centers.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
2. Detail enclosure types and details for types other than NEMA 250, Type 1.
3. Detail bus configuration, current, and voltage ratings.
4. Short-circuit current rating of panelboards and overcurrent protective devices.
5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
6. Include wiring diagrams for power, signal, and control wiring.
7. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Keys: Two spares for each type of panelboard cabinet lock.
2. Circuit Breakers Including GFCI and Ground Fault Equipment Protection (GFEP) Types: Two spares for each panelboard.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NEMA PB 1.

C. Comply with NFPA 70.

1.6 PROJECT CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.7 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Enclosures: Flush- and surface-mounted cabinets.

1. Rated for environmental conditions at installed location.

a. Indoor Dry and Clean Locations: NEMA 250, Type 1.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, ma box dimensions; for flush-mounted fronts, overlap box.
3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
4. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
5. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
6. Finishes:

    a. Panels and Trim: Steel factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
    b. Back Boxes: Same finish as panels and trim.

7. Directory Card: Inside panelboard door, mounted in metal frame with transparent protective cover.

B. Incoming Mains Location: Top and bottom.

C. Phase, Neutral, and Ground Buses:

1. Material: Tin-plated aluminum.
2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.

D. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Tin-plated aluminum.
2. Main and Neutral Lugs: Mechanical type.
3. Ground Lugs and Bus-Configured Terminators: Mechanical type.
4. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.

E. Service Equipment Label: NRTL labeled for use as service equipment for panelboards or load centers with one or more main service disconnecting and overcurrent protective devices.

F. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

G. Panelboard Short-Circuit Current Rating: Fully rated or rated for series-connected system with integral or remote upstream overcurrent protective devices and labeled by an NRTL. Include size and type of allowable upstream and branch devices, and listed and labeled for series-connected short-circuit rating by an NRTL.

2.2 DISTRIBUTION PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Panelboards: NEMA PB 1, power and feeder distribution type.

C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

1. For doors more than 36 inches high, provide two latches, keyed alike.

D. Mains: As scheduled.

E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.

F. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

C. Mains: As scheduled

D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.4 LOAD CENTERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Load Centers: Comply with UL 67.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

C. Mains: Lugs only.

D. Branch Overcurrent Protective Devices: Plug-in circuit breakers, replaceable without disturbing adjacent units.

E. Conductor Connectors: Mechanical type for main, neutral, and ground lugs and buses.

2.5 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:

    a. Instantaneous trip.
    b. Long- and short-time pickup levels.
    c. Long- and short-time time adjustments.
    d. Ground-fault pickup level, time delay, and I^2t response.

4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
5. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
6. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
7. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
8. Molded-Case Circuit-Breaker (MCCB) Features and Accessories as shown on panel schedules:

    a. Standard frame sizes, trip ratings, and number of poles.
    b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
    c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjusta pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
e. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.

B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.

C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install panelboards and accessories according to NEMA PB 1.1.

B. Mount panels in non-residential spaces with top of trim 90 inches above finished floor unless otherwise indicated.

C. Mount panels in residential spaces so no circuit breaker handle is more than 48” above finished floor.

D. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

E. Install overcurrent protective devices and controllers not already factory installed.

1. Set field-adjustable, circuit-breaker trip ranges.

F. Install filler plates in unused spaces.

G. Stub four 1-inch (27-GRC) empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch (27-GRC) empty conduits into raised floor space or below slab not on grade.

H. Comply with NECA 1.

I. Install Arc fault circuit interrupter type circuit breakers in residential circuits per NEC 210.12

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Section 260553 "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

C. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

D. Panelboards will be considered defective if they do not pass tests and inspections.

3.5 ADJUSTING

A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as indicated.

C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.

1. Measure as directed during period of normal system loading.
2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

3.6 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION 262416

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

SECTION 262713 - ELECTRICITY METERING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes equipment for electricity metering by utility company.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Receive, store, and handle modular meter center according to NECA 400.

1.6 COORDINATION

A. Electrical Service Connections: Coordinate with utility companies and components they furnish as follows:

1. Comply with requirements of utilities providing electrical power services.
2. Coordinate installation and connection of utilities and services, including provision for electricity-metering components.

PART 2 - PRODUCTS

2.1 EQUIPMENT FOR ELECTRICITY METERING BY UTILITY COMPANY

A. Meters will be furnished by utility company.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

B. Modular Meter Center: Factory-coordinated assembly of a main service disconnect devi wireways, tenant meter socket modules, and tenant feeder circuit breakers arranged in adjacent vertical sections. Assembly shall be complete with interconnecting buses and other features as specified below.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
   b. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
   c. Siemens Energy & Automation, Inc.
   d. Square D; a brand of Schneider Electric.

2. Comply with requirements of utility company for meter center.
3. Housing: NEMA 250, Type 3R enclosure.
4. Minimum Short-Circuit Rating: 42,000 A symmetrical at rated voltage.
5. Main Disconnect Device: Circuit breaker, series-combination rated for use with downstream feeder and branch circuit breakers.
6. Tenant Feeder Circuit Breakers: Series-combination-rated molded-case units, rated to protect circuit breakers in downstream tenant and house load centers that have 10,000A interrupting capacity.

   a. Identification: Complying with requirements in Section 260553 "Identification for Electrical Systems" with legend identifying tenant's address.
   b. Physical Protection: Tamper resistant, with hasp for padlock.

7. Meter Socket: Rating coordinated with indicated tenant feeder circuit rating.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with equipment installation requirements in NECA 1.

B. Install meters furnished by utility company. Install raceways and equipment according to utility company's written requirements. Provide empty conduits for metering leads and extend grounding connections as required by utility company.

3.2 IDENTIFICATION

A. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

1. Series Combination Warning Label: Self-adhesive type, with text as required by NFPA 70.
2. Equipment Identification Labels: Adhesive film labels with clear protective overlay.

END OF SECTION 262713

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Weather-resistant receptacles.
3. Snap switches and wall-box dimmers.
4. Wall-switch and exterior occupancy sensors.
5. Cord and plug sets.

1.3 DEFINITIONS

A. GFCI: Ground-fault circuit interrupter.

B. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

C. UTP: Unshielded twisted pair.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Receptacles for Owner-Furnished Equipment: Match plug configurations.
2. Cord and Plug Sets: Match equipment requirements.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.6 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

PART 2 - PRODUCTS

A. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:

1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
2. Devices shall comply with the requirements in this Section.

2.3 STRAIGHT-BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.

2.4 GFCI RECEPTACLES

A. General Description:

1. Tamper resistant Straight blade, feed-through type.
2. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.
3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A

2.5 CORD AND PLUG SETS

A. Description:

1. Match voltage and current ratings and number of conductors to requirements of equipment being connected.
2. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and ampacity of at least 130 percent of the equipment rating.
3. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

2.6 TOGGLE SWITCHES

A. Comply with NEMA WD 1, UL 20, and FS W-S-896.

B. Switches, 120/277 V, 20 A:

2.7 RESIDENTIAL DEVICES

A. Residential-Grade, Tamper-Resistant Convenience Receptacles, 125 V, 15 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, and UL 498.

1. Description: Labeled to comply with NFPA 70, "Receptacles, Cord Connectors, and Attachment Plugs (Caps)" Article, "Tamper-Resistant Receptacles in Dwelling Units" Section.

B. Weather-Resistant and Tamper-Resistant Convenience Receptacles, 125 V, 15 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, and UL 498.

1. Description: Labeled to comply with NFPA 70, "Receptacles, Cord Connectors, and Attachment Plugs (Caps)" Article, "Tamper-Resistant Receptacles in Dwelling Units" Section, when installed in wet and damp locations.

C. Telephone Outlet:

1. Description: Single RJ-45 jack for terminating 100-ohm, balanced, four-pair UTP; TIA/EIA-568-B.1; complying with Category 5e. Comply with UL 1863.

D. Combination TV and Telephone Outlet:

1. Description: Single RJ-45 jack for 100-ohm, balanced, four-pair UTP; TIA/EIA-568-B.1; complying with Category 5e. Comply with UL 1863.

2.8 WALL PLATES

A. Single and combination types shall match corresponding wiring devices.
1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: Smooth, high-impact thermoplastic.
3. Material for Unfinished Spaces: Galvanized steel.
4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant**,** die-cast aluminum with lockable cover.

2.9 FINISHES

A. Device Color:

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1. As selected by Architect unless otherwise indicated or required by NFPA 70 or dev listing.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. Coordination with Other Trades:

1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.

D. Device Installation:

1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

9. When mounting into metal boxes, remove the fiber or plastic washers used to h device-mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the right.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

3.2 IDENTIFICATION

A. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.3 FIELD QUALITY CONTROL

A. Test straight-blade for the retention force of the grounding blade according to NFPA 99. Retention force shall be not less than 4 oz. (115 g).

B. Wiring device will be considered defective if it does not pass tests and inspections.

END OF SECTION 262726

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

SECTION 265100 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Interior lighting fixtures, LEDs and drivers.
2. Emergency lighting units.
3. Exit signs.
4. Lighting fixture supports.

1.3 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color-rendering index.

C. Lumen: Measured output of lamp and luminaire, or both.

D. Luminaire: Complete lighting fixture.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:

1. Physical description of lighting fixture including dimensions.
2. Emergency lighting units including battery and charger.
3. Energy-efficiency data.
4. Life, output (lumens, CCT, and CRI), and energy-efficiency data for lamps.
5. Lamp data including dimensions, color temperature and power consumption
6. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing & Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps, and accessories identical to those indicated for the lighting fixture as applied in this Project.

a. Testing Agency Certified Data: For indicated fixtures, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining fixtures shall be certified by manufacturer.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

b. Manufacturer Certified Data: Photometric data shall be certified by a manufactu laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Installation instructions.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.

1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps: 10 of each type and rating installed. Furnish at least one of each type.
2. Plastic Diffusers and Lenses: One of each type and rating installed. Furnish at least one of each type.
3. Globes and Guards: 1 of each type and rating installed. Furnish at least one of each type.

1.7 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

1.8 COORDINATION

A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, product(s) indicated on Drawings.

2.2 GENERAL REQUIREMENTS FOR LIGHTING FIXTURES AND COMPONENTS

A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

B. Metal Parts: Free of burrs and sharp corners and edges.

C. Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging.

D. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

E. Diffusers and Globes:

1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

   a. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.
   b. UV stabilized.

2. Glass: Annealed crystal glass unless otherwise indicated.

2.3 LEDs:

1. The light source of the luminaires shall consist of LED arrays or bars. If required, the LED arrays or bars shall be removable.
2. The LEDs shall be either white or RGB, according to the light fixture schedule and Drawings. For luminaires specified with white light, it is not acceptable to provide RGB LEDs mixed to produce white light.
3. Refer to the light fixture schedule and Drawings for the specified correlated color temperature (CCT) of each luminaire.
4. Individual LEDs shall be binned by manufacturer to comply with ANSI C78.377.
5. The LEDs shall be manufactured by Cree, Philips, Toshiba, Osram, Samsung, or Nichia, unless otherwise noted.

2.4 DRIVERS:

1. The driver or power supply for the luminaire shall be modular and replaceable.
2. The rated life of the driver shall match the rated life of the LEDs and luminaire.
3. In general, the drive current rating of the driver shall be minimized, while still maintaining the required lumen output, to improve luminaire efficiency and life.
4. The driver shall meet the emission standards of IEC EN-61000-6-3 at a minimum. For healthcare or other applications with EMI sensitive equipment, provide drivers that meet more stringent standards as required.

2.5 EXIT SIGNS

A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

B. Internally Lighted Signs:

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1. Lamps for AC Operation: LEDs, 50,000 hours minimum rated lamp life.
2. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.

    a. Battery: Sealed, maintenance-free, nickel-cadmium type.
    b. Charger: Fully automatic, solid-state type with sealed transfer relay.
    c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
    d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
    e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

2.6 EMERGENCY LIGHTING UNITS

A. General Requirements for Emergency Lighting Units: Self-contained units complying with UL 924.

1. Battery: Sealed, maintenance-free, lead-acid type.
2. Charger: Fully automatic, solid-state type with sealed transfer relay.
3. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
4. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
5. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Lighting fixtures:

1. Set level, plumb, and square with ceilings and walls unless otherwise indicated.
2. Install lamps in each luminaire.

B. Temporary Lighting: If it is necessary, and approved by Architect, to use permanent luminaires for temporary lighting, install and energize the minimum number of luminaires necessary. When construction is sufficiently complete, remove the temporary luminaires, disassemble, clean thoroughly, install new lamps, and reinstall.

C. Suspended Lighting Fixture Support:

1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for sus for each unit length of fixture chassis, including one at each end.
4. Do not use grid as support for pendant luminaires. Connect support wires or rods to building structure.

D. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.2 IDENTIFICATION

A. Install labels with panel and circuit numbers on concealed junction and outlet boxes. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.3 FIELD QUALITY CONTROL

A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.

3.4 STARTUP SERVICE

A. Burn-in all lamps that require specific aging period to operate properly, prior to occupancy by Owner. Burn-in fluorescent and compact fluorescent lamps intended to be dimmed, for at least 100 hours at full voltage.

3.5 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting aimable luminaires to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose. Some of this work may be required after dark.

1. Adjust aimable luminaires in the presence of Architect.

END OF SECTION 265100

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

SECTION 265600 - EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior LED luminaires.
2. Poles and accessories.

1.2 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color-rendering index.

C. HID: High-intensity discharge.

D. LER: Luminaire efficacy rating.

E. Luminaire: Complete lighting fixture, including ballast housing if provided.

F. Pole: Luminaire support structure, including tower used for large area illumination.

1.3 ACTION SUBMITTALS

A. Product Data: For each luminaire, pole, and support component, arranged in order of lighting unit designation. Include data on features, accessories, finishes, and the following:

1. Physical description of luminaire, including materials and dimensions.
2. Details of installation and construction.
3. Luminaire materials.
4. Photometric data based on laboratory tests of each luminaire type, complete with indicated lamps, ballasts, and accessories.
    a. Manufacturer Certified Data: Photometric data shall be certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
5. Photoelectric relays.
6. Lamps, including life, output, CCT, CRI, lumens, and energy-efficiency data.
7. Materials, dimensions, and finishes of poles.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and poles to include in emergency, operation, and maintenance manuals.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1.5 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with IEEE C2, "National Electrical Safety Code."

D. Comply with NFPA 70.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store poles on decay-resistant-treated skids at least 12 inches (300 mm) above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.

B. Retain factory-applied pole wrappings on metal poles until right before pole installation. For poles with nonmetallic finishes, handle with web fabric straps.

1.7 WARRANTY

1. Warranty Period for Luminaires: Five years from date of Substantial Completion.
2. Warranty Period for Luminaires Poles: Repair or replace Luminaires and lighting poles and standards that fail in finish, materials, and workmanship within manufacturer's standard warranty period, but not less than three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, product(s) indicated on Drawings.

2.2 EXTERIOR LED LUMINAIRES

A. LED luminaire housings shall be die cast or extruded aluminum.

B. Luminaires shall be UL listed for wet locations per UL 1598.

C. Luminaires shall have IES distribution and NEMA field angle classifications as indicated in luminaire schedule on project plans per IES HB-10.

D. Luminaires shall be fully assembled and electrically tested prior to shipment from factory.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

E. The finish color shall be as indicated in the luminaire schedule or detail on the project plans.

F. Luminaires shall have a nameplate bearing the manufacturer's name, address, model number, date of manufacture, and serial number securely affixed in a conspicuous place.

G. LED Light Sources

1. Correlated Color Temperature (CCT) shall be in accordance with NEMA ANSLG C78.377

H. Luminaire Power Supply Units (Drivers)

1. Minimum efficiency shall be 85 percent.
2. Shall be rated to operate between ambient temperatures of minus 22 degrees F and 122 degrees F
3. Shall be designed to operate on the voltage system to which they are connected, typically ranging from 120 V to 480 V nominal.
4. Power Factor (PF) shall be greater than or equal to 0.90.
5. Total Harmonic Distortion (THD) current shall be less than or equal to 20 percent.
6. Shall be mounted integral to luminaire. Remote mounting of power supply is not allowed.
7. Power supplies in luminaires mounted under a covered structure, such as a canopy, or where otherwise appropriate shall be UL listed with a sound rating of A.
8. Shall be dimmable, and compatible with a standard dimming control circuit of 0 - 10V or other approved dimming system.
9. Shall be equipped with over-temperature protection circuit that turns light source off until normal operating temperature is achieved.

PART 3 - EXECUTION

3.1 LUMINAIRE INSTALLATION

A. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources, favoring a north orientation.

3.2 POLE INSTALLATION

A. Alignment: Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on the pole.

B. Foundation-Mounted Poles: Mount poles as recommended by pole manufacturer.

1. Grout void between pole base and foundation. Use nonshrink or expanding concrete grout firmly packed to fill space.

C. Raise and set poles using web fabric slings (not chain or cable).

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

3.3 CORROSION PREVENTION

A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.

B. Steel Conduits: Comply with Section 260533 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch- (0.254-mm-) thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.4 GROUNDING

A. Ground metal poles and support structures according to Section 260526 "Grounding and Bonding for Electrical Systems."

1. Install grounding electrode for each pole unless otherwise indicated.
2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.

3.5 FIELD QUALITY CONTROL

A. Inspect each installed fixture for damage. Replace damaged fixtures and components.

B. Illumination Observations: Verify normal operation of lighting units after installing luminaires and energizing circuits with normal power source.

1. Verify operation of photoelectric controls.

END OF SECTION 265600

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

SECTION 271500 - COMMUNICATIONS HORIZONTAL CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. UTP cabling.
2. Coaxial Cable
3. Cable connecting hardware, patch panels, and cross-connects.
4. Telecommunications outlet/connectors.
5. Cabling system identification products.

1.3 DEFINITIONS

A. BICSI: Building Industry Consulting Service International.

B. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.

C. EMI: Electromagnetic interference.

D. IDC: Insulation displacement connector.

E. LAN: Local area network.

F. Outlet/Connectors: A connecting device in the work area on which horizontal cable or outlet cable terminates.

G. RCDD: Registered Communications Distribution Designer.

H. UTP: Unshielded twisted pair.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordinate layout and installation of telecommunications cabling with Owner's telecommunications and LAN equipment and service suppliers.

B. Coordinate telecommunications outlet/connector locations with location of power receptacles at each work area.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer**,** qualified layout technician, installation supervisor, and field inspector.

B. Source quality-control reports.

C. Field quality-control reports.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Patch-Panel Units: One of each type.
2. Connecting Blocks: One of each type.
3. Device Plates: One of each type.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

1. Layout Responsibility: Preparation of Shop Drawings and Cabling Administration Drawings an RCDD.
2. Installation Supervision: Installation shall be under the direct supervision of Registered Technician, who shall be present at all times when Work of this Section is performed at Project site.
3. Testing Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site.
1. Test each pair of UTP cable for open and short circuits.

PART 2 - PRODUCTS

2.1 HORIZONTAL CABLING DESCRIPTION

A. Horizontal cable and its connecting hardware provide the means of transporting signals between the telecommunications outlet/connector and the horizontal cross-connect located in the

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

communications equipment room. This cabling and its connecting hardware are called "permanent link," a term that is used in the testing protocols.

1. TIA/EIA-568-B.1 requires that a minimum of two telecommunications outlet/connectors be installed for each work area.
2. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications outlet/connector.
3. Bridged taps and splices shall not be installed in the horizontal cabling.

B. The maximum allowable horizontal cable length is 295 feet (90 m). This maximum allowable length does not include an allowance for the length of 16 feet (4.9 m) to the workstation equipment or in the horizontal cross-connect.

2.2 PERFORMANCE REQUIREMENTS

A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA/EIA-568-B.1 when tested according to test procedures of this standard.

B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 50 or less.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Grounding: Comply with J-STD-607-A.

2.3 UTP CABLE

A. Description: 100-ohm, four-pair UTP, covered with a blue thermoplastic jacket.

1. Comply with ICEA S-90-661 for mechanical properties.
2. Comply with TIA/EIA-568-B.1 for performance specifications.
3. Comply with TIA/EIA-568-B.2, **Category 6**.
4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:

    a. Communications, General Purpose: Type CM or CMG.
    b. Communications, Plenum Rated: Type CMP, complying with NFPA 262.
    c. Communications, Riser Rated: Type CMR, complying with UL 1666.
    d. Communications, Limited Purpose: Type CMX.
    e. Multipurpose: Type MP or MPG.
    f. Multipurpose, Plenum Rated: Type MPP, complying with NFPA 262.
    g. Multipurpose, Riser Rated: Type MPR, complying with UL 1666.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

2.4 UTP CABLE HARDWARE

A. General Requirements for Cable Connecting Hardware: Comply with TIA/EIA-568-B.2, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.

B. Connecting Blocks: 110-style IDC for **Category 6**. Provide blocks for the number of cables terminated on the block, plus 25 percent spare. Integral with connector bodies, including plugs and jacks where indicated.

C. Cross-Connect: Modular array of connecting blocks arranged to terminate building cables and permit interconnection between cables.

D. Patch Panel: Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables.

E. Jacks and Jack Assemblies: Modular, color-coded, eight-position modular receptacle units with integral IDC-type terminals.

1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure **Category 6** performance. Patch cords shall have latch guards to protect against snagging.

2.5 COAXIAL CABLE

A. The drop cable shall be plenum rated RG-6U with 100% shielding. The cable shall be West Penn Wire 25841, or equal.

2.6 TELECOMMUNICATIONS OUTLET/CONNECTORS

A. Jacks: 100-ohm, balanced, twisted-pair connector; four-pair, eight-position modular. Comply with TIA/EIA-568-B.1.

B. Workstation Outlets: Port-connector assemblies, with quantities shown on drawings, mounted in single faceplate.

1. Plastic Faceplate: High-impact plastic. Coordinate color with Section 262726 "Wiring Devices."
2. For use with snap-in jacks accommodating any combination of UTP.
3. Legend: Machine printed, in the field, using adhesive-tape label.
4. Legend: Snap-in, clear-label covers and machine-printed paper inserts.

2.7 GROUNDING

A. Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems" for grounding conductors and connectors.

B. Comply with J-STD-607-A.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

2.8 IDENTIFICATION PRODUCTS

A. Comply with TIA/EIA-606-A and UL 969 for labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

B. Comply with requirements in Section 260553 "Identification for Electrical Systems."

PART 3 - EXECUTION

3.1 WIRING METHODS

A. Install cables in pathways and cable trays except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Conceal pathways and cables except in unfinished spaces.

1. Install plenum cable in environmental air spaces, including plenum ceilings.

B. Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures:

1. Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.
2. Install lacing bars and distribution spools.
3. Install conductors parallel with or at right angles to sides and back of enclosure.

3.2 INSTALLATION OF CABLES

A. Comply with NECA 1.

B. General Requirements for Cabling:

1. Comply with TIA/EIA-568-B.1.
2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
3. Install 110-style IDC termination hardware unless otherwise indicated.
4. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
5. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
6. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
7. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

8. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice ca between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
9. In the communications equipment room, install a 10-foot- (3-m-) long service loop on each end of cable.
10. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

C. UTP Cable Installation:

1. Comply with TIA/EIA-568-B.2.
2. Do not untwist UTP cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.

D. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend UTP cable not in a wireway or pathway a minimum of 8 inches (200 mm) above ceilings by cable supports not more than 60 inches (1524 mm) apart.
3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

E. Group connecting hardware for cables into separate logical fields.

F. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA-569-B for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:

    a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches (127 mm).
    b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches (300 mm).
    c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches (610 mm).

3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:

    a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches (64 mm).
    b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches (150 mm).
    c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches (300 mm).

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:

    a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
    b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches (76 mm).
    c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).

5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).
6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).

3.3 FIRESTOPPING

A. Comply with requirements in Section "Penetration Firestopping."

B. Comply with TIA-569-B, Annex A, "Firestopping."

C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.4 GROUNDING

A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. Comply with J-STD-607-A.

C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch (50-mm) clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.

D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

3.5 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements for identification specified in Section "Identification for Electrical Systems."

B. Cable Schedule: Post in prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

C. Cabling Administration Drawings: Show building floor plans with cabling administration-pc labeling. Identify labeling convention and show labels for telecommunications closets, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors. Follow convention of TIA/EIA-606-A. Furnish electronic record of all drawings, in software and format selected by Owner.

D. Cable and Wire Identification:

1. Label each cable within 4 inches (100 mm) of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet (4.5 m).
4. Label each terminal strip and screw terminal in each cabinet, rack, or panel.

    a. Individually number wiring conductors connected to terminal strips, and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with name and number of particular device as shown.
    b. Label each unit and field within distribution racks and frames.

5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.

E. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA/EIA-606-A.

1. Cables use flexible vinyl or polyester that flex as cables are bent.

3.6 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Visually inspect UTP and optical fiber cable jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA/EIA-568-B.1.
2. Visually confirm **Category 6**, marking of outlets, cover plates, outlet/connectors, and patch panels.
3. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.

B. End-to-end cabling will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

END OF SECTION 271500

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

SECTION 283111 - DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fire-alarm control unit.
2. Manual fire-alarm boxes.
3. System smoke detectors.
4. Nonsystem smoke detectors.
5. Nonsystem combination smoke/CO detectors
6. Heat detectors.
7. Notification appliances.
8. Magnetic door holders.
9. Remote annunciator.
10. Addressable interface device.
11. Digital alarm communicator transmitter.

1.2 SYSTEM DESCRIPTION

A. Noncoded, addressable system, with multiplexed signal transmission, dedicated to fire-alarm service only.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For fire-alarm system. Include plans, elevations, sections, details, and attachments to other work.

1. Comply with recommendations in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72.
2. Include voltage drop calculations for notification appliance circuits.
3. Include battery-size calculations.
4. Include performance parameters and installation details for each detector, verifying that each detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
5. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale and coordinating installation of duct smoke detectors and access to them. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators. Locate detectors according to manufacturer's written recommendations.

C. General Submittal Requirements:

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1. Submittals shall be approved by authorities having jurisdiction prior to submitting th to Architect.
2. Shop Drawings shall be prepared by persons with the following qualifications:

    a. Trained and certified by manufacturer in fire-alarm system design.
    b. NICET-certified fire-alarm technician, Level III minimum.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Comply with the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
2. Provide "Record of Completion Documents" according to NFPA 72 article "Permanent Records" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter.
3. Record copy of site-specific software.
4. Provide "Maintenance, Inspection and Testing Records" according to NFPA 72 article of the same name and include the following:

    a. Frequency of testing of installed components.
    b. Frequency of inspection of installed components.
    c. Requirements and recommendations related to results of maintenance.
    d. Manufacturer's user training manuals.

5. Manufacturer's required maintenance related to system warranty requirements.
6. Abbreviated operating instructions for mounting at fire-alarm control unit.

B. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On magnetic media or compact disk, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

B. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-ala Level II technician.

C. Source Limitations for Fire-Alarm System and Components: Obtain fire-alarm system from single source from single manufacturer. Components shall be compatible with, and operate as, an extension of existing system.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.7 SOFTWARE SERVICE AGREEMENT

A. Comply with UL 864.

B. Technical Support: Beginning with Substantial Completion, provide software support for two years.

C. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.

1. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

PART 2 - PRODUCTS

2.1 SYSTEMS OPERATIONAL DESCRIPTION

A. Fire-alarm signal initiation shall be by one or more of the following devices:

1. Manual stations.
2. Heat detectors.
3. Smoke detectors.
4. Duct smoke detectors.
5. Automatic sprinkler system water flow.
6. Heat detectors in elevator shaft and pit.

B. Fire-alarm signal shall initiate the following actions:

1. Continuously operate alarm-notification appliances.
2. Identify alarm at the fire-alarm control unit and remote annunciators.
3. Transmit an alarm signal to the remote alarm receiving station.
4. Release fire and smoke doors held open by magnetic door holders.
5. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
6. Recall elevators to primary or alternate recall floors.
7. Record events in the system memory.
8. Actuate Fire/Smoke Dampers associated with duct smoke detectors.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

9. Open elevator shaft smoke damper.

C. Supervisory signal initiation shall be by one or more of the following devices and actions:

1. Valve supervisory switch.
2. Elevator shunt-trip supervision.

D. System trouble signal initiation shall be by one or more of the following devices and actions:

1. Open circuits, shorts, and grounds in designated circuits.
2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
3. Loss of primary power at fire-alarm control unit.
4. Ground or a single break in fire-alarm control unit internal circuits.
5. Abnormal ac voltage at fire-alarm control unit.
6. Break in standby battery circuitry.
7. Failure of battery charging.
8. Abnormal position of any switch at fire-alarm control unit or annunciator.

E. System Trouble and Supervisory Signal Actions: Initiate notification appliance and annunciate at fire-alarm control unit and remote annunciators.

2.2 FIRE-ALARM CONTROL UNIT

A. General Requirements for Fire-Alarm Control Unit:

1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864 and listed and labeled by an NRTL.

    a. System software and programs shall be held in flash electrically erasable programmable read-only memory (EEPROM), retaining the information through failure of primary and secondary power supplies.
    b. Include a real-time clock for time annotation of events on the event recorder and printer.

2. Addressable control circuits for operation of mechanical equipment.

B. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.

1. Annunciator and Display: Liquid-crystal type, 3 line(s) of 80 characters, minimum.
2. Keypad: Arranged to permit entry and execution of programming, display, and control commands.

C. Circuits:

1. Initiating Device, Notification Appliance, and Signaling Line Circuits: NFPA 72, Class A.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

a. Initiating Device Circuits: Style D.
b. Notification Appliance Circuits: Style Z.
c. Signaling Line Circuits: Style 6.
d. Install no more than 50 addressable devices on each signaling line circuit.

D. Elevator Recall:

1. Smoke detectors at the following locations shall initiate automatic elevator recall.

a. Elevator lobby detectors except the lobby detector on the designated floor.
b. Smoke detector in elevator machine room.
c. Smoke detectors in elevator hoistway.

2. Elevator lobby detectors located on the designated recall floors shall be programmed to move the cars to the alternate recall floor.
3. Water-flow alarm connected to sprinkler in an elevator shaft and elevator machine room shall shut down elevators associated with the location without time delay.

a. Water-flow switch associated with the sprinkler in the elevator pit may have a delay to allow elevators to move to the designated floor.

E. Door Controls: Door hold-open devices that are controlled by smoke detectors at doors in smoke barrier walls shall be connected to fire-alarm system.

F. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.

G. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, and supervisory signals shall be powered by 24-V dc source.

1. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.

H. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.

1. Batteries: Sealed lead calcium.

I. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

2.3 MANUAL FIRE-ALARM BOXES

A. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1. Double-action mechanism requiring two actions to initiate an alarm, pull-lever type; w integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
2. Station Reset: Key- or wrench-operated switch.

2.4 SYSTEM SMOKE DETECTORS

A. General Requirements for System Smoke Detectors:

1. Comply with UL 268; operating at 24-V dc, nominal.
2. Detectors shall be four-wire type.
3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
6. Integral Visual-Indicating Light: LED type indicating detector has operated and power-on status.

B. Photoelectric Smoke Detectors:

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

    a. Primary status.
    b. Device type.
    c. Present average value.
    d. Present sensitivity selected.
    e. Sensor range (normal, dirty, etc.).

C. Duct Smoke Detectors: Photoelectric type complying with UL 268A.

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

    a. Primary status.
    b. Device type.
    c. Present average value.
    d. Present sensitivity selected.
    e. Sensor range (normal, dirty, etc.).

3. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector.
4. Each sensor shall have multiple levels of detection sensitivity.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

5. Sampling Tubes: Design and dimensions as recommended by manufacturer for spec duct size, air velocity, and installation conditions where applied.
6. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.

2.5 NONSYSTEM SMOKE DETECTORS

A. The smoke alarm shall be Kidde model PE120 or approved equal. It shall be powered by a 120VAC, 60Hz, 80mA source along with a 9V battery backup. The unit shall incorporate a photoelectric sensor with nominal sensitivity of 2.06%/ft. The temperature operation range shall be between 40˚F and 100˚F (4˚C and 38˚C) and the humidity operation range shall be 5% - 95% relative humidity.

B. The smoke alarm can be installed on any standard single gang electrical box, up to a 4" octagon junction box. The electrical connection (to the alarm) shall be made with a plug-in connector. All devices in an apartment shall have the ability to be interconnected in a multiple station arrangement. The interconnect system must not exceed the NFPA (National Fire Protection Association) limit of 18 initiating devices, of which 12 can be smoke alarms. The unit shall provide optional tamper resistance that deters removal of the unit from the wall or ceiling.

C. The alarm shall include a test button that will electronically simulate the presence of smoke and cause the unit to go into alarm. This sequence must test the unit's electronics, battery and horn to ensure proper operation.

D. The unit shall include a piezoelectric horn that is rated at 85dB at 10 feet. The unit shall also include a low battery warning utilizing a brief alarm chirp every 30-40 seconds for a minimum of seven (7) days.

E. The unit shall incorporate one red LED to indicate the alarm's current status and mode of operation. The red LED will indicate one of two conditions:

1. Standby Condition: The red LED will flash every 30-40 seconds to indicate that the smoke alarm is operating properly.
2. Alarm Condition: When the alarm senses products of combustion and goes into alarm, the red LED will flash rapidly (one flash per second). The rapid flashing LED and pulsating alarm will continue until the air is cleared.

F. The unit shall incorporate one green LED to indicate the presence of AC power. The unit shall at a minimum meet the requirements of UL217, NFPA72, (chapter 11 2002 edition), NFPA 101 (One and two family dwellings) Federal Housing Authority (FHA), Housing and Urban Development (HUD). It shall also include a 10-year manufacture's limited warranty.

2.6 NONSYSTEM COMBINATION CO/SMOKE DETECTORS

A. The combination smoke and carbon monoxide alarm shall be Kidde Unit Number KN-COPE-IC or approved equal. It shall be powered by 120VAC, 60Hz source with a 9V battery backup. The temperature operating range shall be between 40°F and 100°F (4°C and 38°C) and the humidity operating range shall be 5% - 85% relative humidity.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

B. The unit shall incorporate a photoelectric smoke sensor with nominal sensitivity of 2.05% The CO sensor shall be of a fuel cell design and shall meet the sensitivity requirements of Underwriters Laboratories UL2034 Single and Multiple Station Carbon Monoxide Detectors.

C. The combination alarm shall be installed on the surface of any wall or ceiling following the UL/ NFPA/Manufacturer's recommended placement guidelines. The alarm can be installed on any standard single gang electrical box, up to a 4" octagon junction box. The electrical connection (to the alarm) shall be made with a plug-in connector. The unit shall provide optional tamper resistance that deters removal of the unit from the wall or ceiling. No additional pieces shall be required to activate this feature.

D. The interconnect system must not exceed the NFPA (National Fire Protection Association) limit of 18 initiating devices, of which 12 can be smoke alarms. With 18 initiating devices (smoke, heat, CO, etc), interconnected, it is still possible to interconnect 6 strobe lights and or relay modules.

E. The alarm shall include a test button that will electronically simulate the presence of smoke and CO and cause the unit to go into both modes of alarm. This sequence tests the unit's electronics to ensure proper operation. The CO sensor will not alarm to levels of CO below 30 ppm and will alarm in the following time range when exposed to the corresponding levels of CO.

1. 70 ppm CO Concentration 60 – 240 minutes
2. 150 ppm CO Concentration 10 – 50 minutes
3. 400 ppm CO Concentration 4 – 15 minutes

F. The combination alarm shall have two methods of warning for danger: a piezoelectric horn that is rated at 85 decibels at 10 feet and a voice warning that identifies the danger. For a CO incident, the horn will sound in the repetitive manner – four (4) fast beeps, a short pause, four (4) fast beeps, a short pause. In between, the unit will announce "Warning Carbon Monoxide!" In a Smoke incident, the horn will sound in the repetitive manner – three (3) beeps, a pause, three (3) beeps, a pause. In between, the unit will announce "Fire! Fire!" The unit shall incorporate 2 LED's. A green LED will be steady on when AC power is present, flash every 30 seconds when in the battery only mode, every 16 seconds to indicate alarm memory, and every 2 seconds to indicate the Hush "mode is active. A red LED will flash in unison with the sounder pat- tern. The unit shall include the Smart Hush™ feature that silences the unit for approximately 8 minutes if a nuisance alarm condition occurs. The Green LED on the alarm will flash every 2 seconds while in Smart Hush™ and will automatically reset itself. It also provides voice annunciation of "Hush Activated" when Smart Hush™ is activated and "Hush Cancelled" when the Hush cycle ends.

2.7 The unit shall also indicate a low battery warning utilizing each of the following methods: a brief alarm chirp, the voice announcement of "Low Battery!" The unit shall at a minimum meet the requirements of UL 2034, UL217, NFPA72.

A. General Requirements for Heat Detectors: Comply with UL 521.

2.8 HEAT DETECTORS

A. General Requirements for Heat Detectors: Comply with UL 521.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

B. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F (57 deg C) or a rate of rise that exceeds 15 deg F (8 deg C) per minute unless otherwise indicated.

1. Mounting: Twist-lock base interchangeable with smoke-detector bases.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

2.9 NOTIFICATION APPLIANCES

A. General Requirements for Notification Appliances: Connected to notification appliance signal circuits, zoned as indicated, equipped for mounting as indicated and with screw terminals for system connections.

1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated and with screw terminals for system connections.

B. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet (3 m) from the horn, using the coded signal prescribed in UL 464 test protocol.

C. Visible Notification Appliances: Xenon strobe lights comply with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- (25-mm-) high letters on the lens.

1. Rated Light Output:

   a. General devices 15/30/75/110 cd, selectable in the field.
   b. Sleeping area devices 135/150/177/185 cd, selectable in the field

2. Mounting: Wall mounted unless otherwise indicated.
3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
4. Flashing shall be in a temporal pattern, synchronized with other units.
5. Strobe Leads: Factory connected to screw terminals.
6. Mounting Faceplate: Factory finished, red.

2.10 MAGNETIC DOOR HOLDERS

A. Description: Units are equipped for wall or floor mounting as indicated and are complete with matching doorplate.

1. Electromagnet: Requires no more than 3 W to develop 25-lbf (111-N) holding force.
2. Wall-Mounted Units: Flush mounted unless otherwise indicated.
3. Rating: 24-V ac or dc.

B. Material and Finish: Match door hardware.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

2.11 REMOTE ANNUNCIATOR

A. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.

1. Mounting: Flush cabinet, NEMA 250, Type 1.

B. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

2.12 ADDRESSABLE INTERFACE DEVICE

A. Description: Microelectronic monitor module, NRTL listed for use in providing a system address for alarm-initiating devices for wired applications with normally open contacts.

B. Integral Relay: Capable of providing a direct signal to elevator controller to initiate elevator recall or operate Fire/Smoke damper.

2.13 DIGITAL ALARM COMMUNICATOR TRANSMITTER

A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632 and be listed and labeled by an NRTL.

B. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically capture one telephone line and dial a preset number for a remote central station. When contact is made with central station, signals shall be transmitted. If service on line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.

C. Local functions and display at the digital alarm communicator transmitter shall include the following:

1. Verification that both telephone lines are available.
2. Programming device.
3. LED display.
4. Manual test report function and manual transmission clear indication.
5. Communications failure with the central station or fire-alarm control unit.

D. Digital data transmission shall include the following:

1. Address of the alarm-initiating device.
2. Address of the supervisory signal.
3. Address of the trouble-initiating device.
4. Loss of ac supply or loss of power.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

5. Low battery.
6. Abnormal test signal.
7. Communication bus failure.

E. Secondary Power: Integral rechargeable battery and automatic charger.

F. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

A. Comply with NFPA 72 for installation of fire-alarm equipment.

B. Install wall-mounted equipment, with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.

C. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct.

D. Heat Detectors in Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location.

E. Single-Station Smoke Detectors: Where more than one smoke alarm is installed within a dwelling or suite, they shall be connected so that the operation of any smoke alarm causes the alarm in all smoke alarms to sound.

F. Remote Status and Alarm Indicators: Install near each smoke detector and each sprinkler water-flow switch and valve-tamper switch that is not readily visible from normal viewing position.

G. Audible Alarm-Indicating Devices: Install not less than 6 inches (150 mm) below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille.

H. Device Location-Indicating Lights: Locate in public space near the device they monitor.

3.2 CONNECTIONS

A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Section "Door Hardware." Connect hardware and devices to fire-alarm system.

1. Verify that hardware and devices are NRTL listed for use with fire-alarm system in this Section before making connections.

B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 3 feet (1 m) from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

1. Alarm-initiating connection to elevator recall system and components.
2. Supervisory connections at valve supervisory switches.
3. Supervisory connections at elevator shunt trip breaker.

3.3 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

B. Install framed instructions in a location visible from fire-alarm control unit.

3.4 GROUNDING

A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

3.5 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Visual Inspection: Conduct visual inspection prior to testing.
    a. Inspection shall be based on completed Record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" Table in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter.
    b. Comply with "Visual Inspection Frequencies" Table in the "Inspection" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.
2. System Testing: Comply with "Test Methods" Table in the "Testing" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
4. Test audible appliances for the private operating mode according to manufacturer's written instructions.
5. Test visible appliances for the public operating mode according to manufacturer's written instructions.
6. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.

B. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.

C. Fire-alarm system will be considered defective if it does not pass tests and inspections.

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 04/11/17

D. Prepare test and inspection reports.

E. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.

F. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

END OF SECTION 283111