

PROJECT MANUAL FOR:

HOME 2 SUITES

At Trinity Center in Helena, Montana

Owner: Trinity Restoration, LLC

**GENERAL REQUIREMENTS
SPECIFICATIONS
CONSTRUCTION DOCUMENTS**



ARCHITECT: Hip and Humble Architecture, llc
418 South 5th Avenue
Bozeman, Montana 59715
Phone: 406-581-3832
www.HAHAarchitect.com

CONTRACTOR: Langlas & Associates, Inc.
1019 East Main St., Suite 101
Bozeman, Montana 59715
Phone: 406-585-3420
www.Langlas.com

PROJECT NUMBER: #2016-01
DATE: July 29, 2016

SET NUMBER: _____

TABLE OF CONTENTS

DIVISION 01 - GENERAL REQUIREMENTS

01 1000	SUMMARY
01 2000	PRICE AND PAYMENT PROCEDURES
01 2100	ALLOWANCES
01 2300	ALTERNATES
01 3000	ADMINISTRATIVE REQUIREMENTS
01 3216	CONSTRUCTION PROGRESS SCHEDULE
01 4000	QUALITY REQUIREMENTS
01 5000	TEMPORARY FACILITIES AND CONTROLS
01 6000	PRODUCT REQUIREMENTS
01 7000	EXECUTION AND CLOSEOUT REQUIREMENTS
01 7800	CLOSEOUT SUBMITTALS

DIVISION 03 - CONCRETE

03 3000	CAST-IN-PLACE CONCRETE
03 5400	CAST UNDERLAYMENT

DIVISION 04 - MASONRY

04 2000	UNIT MASONRY
04 2001	MASONRY VENEER

DIVISION 05 – METALS

05 1200	STRUCTURAL STEEL FRAMING
05 5000	METAL FABRICATIONS

DIVISION 06 - WOOD, PLASTICS, AND COMPOSITES

06 1000	ROUGH CARPENTRY
06 1600	SHEATHING
06 1753	SHOP-FABRICATED WOOD TRUSSES
06 1800	GLU-LAMINATED CONSTRUCTION
06 2000	FINISH CARPENTRY
06 4100	ARCHITECTURAL WOOD CASEWORK

DIVISION 07 - THERMAL AND MOISTURE PROTECTION

07 1113	BITUMINOUS DAMPPROOFING
07 2100	THERMAL INSULATION
07 2400	EXTERIOR INSULATION AND FINISH SYSTEMS
07 2500	WEATHER BARRIERS
07 4213	METAL WALL PANELS
07 4646	FIBER CEMENT SIDING
07 5300	ELASTOMERIC MEMBRANE ROOFING
07 6200	SHEET METAL FLASHING AND TRIM
07 7200	ROOF ACCESSORIES
07 8400	FIRESTOPPING
07 9200	JOINT SEALANTS

DIVISION 08 - OPENINGS

08 1113	HOLLOW METAL DOORS AND FRAMES
08 1416	FLUSH WOOD DOORS
08 4229	AUTOMATIC ENTRANCES
08 4313	ALUMINUM-FRAMED STOREFRONTS
08 5113	ALUMINUM WINDOWS
08 7100	DOOR HARDWARE
08 8000	GLAZING

DIVISION 09 - FINISHES

09 2116	GYPSUM BOARD ASSEMBLIES
09 3000	TILING
09 5100	SUSPENDED ACOUSTICAL CEILINGS
09 6813	TILE CARPETING
09 7200	WALL COVERINGS
09 7733	GLASS FIBER REINFORCED PLASTIC PANELS
09 9113	EXTERIOR PAINTING
09 9123	INTERIOR PAINTING

DIVISION 10 - SPECIALTIES

10 2800	TOILET, BATH, AND LAUNDRY ACCESSORIES
10 4400	FIRE PROTECTION SPECIALTIES

DIVISION 14 - CONVEYING EQUIPMENT

14 2400	HYDRAULIC ELEVATORS
14 9100	FACILITY CHUTES

DIVISION 21 – FIRE SUPPRESSION

21 1313	FIRE PROTECTION SYSTEMS

DIVISION 22 – PLUMBING

22 0000	COMMON WORK RESULTS FOR PLUMBING
22 0100	FIRESTOPPING FOR PLUMBING
22 0519	GAUGES
22 0523	VALVES
22 0548	VIBRATION CONTROL
22 0553	MECHANICAL IDENTIFICATION
22 0700	INSULATION
22 1113	PIPING MATERIALS AND METHODS
22 1116	PEX PIPING SYSTEMS
22 1119	PIPIING SPECIALTIES
22 1316	SOIL, WASTE, VENT SYSTEMS
22 3500	DOMESTIC WATER SYSTEM
22 4000	PLUMBING FIXTURES

DIVISION 23 – HEATING, VENTILATING AND AIR-CONDITIONING (HVAC)

23 0000	GENERAL PROVISIONS FOR HVAC WORK
23 0593	TESTING AND BALANCING
23 0700	DUCT INSULATION
23 1113	NATURAL GAS PIPING SYSTEMS
23 3113	DUCTWORK AND ACCESSORIES
23 3400	FANS
23 5415	GAS FIRED UNIT HEATERS AND MAKE-UP AIR UNITS
23 6000	REFRIGERATION SYSTEMS
23 7510	PACKAGED HEATING AND COOLING UNITS
23 8220	FAN COIL UNITS

DIVISION 26 – ELECTRICAL

26 0000	GENERAL PROVISIONS FOR ELECTRICAL WORK
26 0519	CONDUCTORS
26 1100	RACEWAYS AND FITTINGS
26 1300	BOXES
26 1410	WIRING DEVICES
26 1550	DISCONNECTS AND MOTOR CONTROLS
26 1600	PANEL BOARDS
26 5000	LIGHTING FIXTURES
26 7230	DIGITAL FIRE ALARM SYSTEM
26 7400	TELEPHONE – TELEVISION
26 8500	ELECTRIC HEATERS

END OF TABLE OF CONTENTS

SECTION 01 1000
SUMMARY

PART 1 GENERAL

1.01 PROJECT

- A. Project Name: Home 2 Suites
- B. Owner's Name: Trinity Restoration, LLC.
- C. Architect's Name: Hip and Humble Architecture, LLC.
- D. The Project consists of the construction of a 4 story, 95 room hotel, meeting rooms and indoor pool which is approximately 58,000 sf gross area in size. This hotel project will include infrastructure, site, landscaping and utility work in addition to the construction of the building..

1.02 CONTRACT DESCRIPTION

- A. Contract Type: Standard form of agreement between Owner and Construction Manager as Constructor based on the Cost of the Work plus a fee with a Guaranteed Maximum Price as described in AIA Document A133.

1.03 WORK BY OWNER

- A. Owner will supply and install the following:
 - 1. See enclosed Responsibility Matrix.
- B. Owner will supply the following for installation by Contractor:
 - 1. See enclosed Responsibility Matrix.

1.04 OWNER OCCUPANCY

- A. Owner intends to occupy the Project upon Substantial Completion.
- B. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.
- C. Schedule the Work to accommodate Owner occupancy.

1.05 CONTRACTOR USE OF SITE AND PREMISES

- A. Construction Operations: Limited to areas noted on Drawings.
- B. Arrange use of site and premises to allow:
 - 1. Owner occupancy.
 - 2. Work by Others.
 - 3. Work by Owner.
- C. Provide access to and from site as required by law and by Owner:
 - 1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
 - 2. Do not obstruct roadways, sidewalks, or other public ways without permit.
- D. Utility Outages and Shutdown:
 - 1. Prevent accidental disruption of utility services to other facilities.

1.06 WORK SEQUENCE

- A. Coordinate construction schedule and operations with Owner.

1.07 AVAILABLE INFORMATION

- A. Digital copies of the Construction Documents are available from the Construction Manager upon request.
- B. Digital copies of the Geotechnical Report completed by Big Sky Civil and Environmental are available from the Construction Manager upon request.

PART 2 PRODUCTS - NOT USED
PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 2000
PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Procedures for preparation and submittal of applications for progress payments.
- B. Documentation of changes in Contract Sum and Contract Time.
- C. Change procedures.
- D. Correlation of Contractor submittals based on changes.
- E. Procedures for preparation and submittal of application for final payment.

1.02 SCHEDULE OF VALUES

- A. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit draft to Architect for approval.
- B. Forms filled out by hand will not be accepted.
- C. Submit Schedule of Values in duplicate within 15 days after date of Owner-Contractor Agreement.
- D. Format: Utilize the Table of Contents of this Project Manual. Identify each line item with number and title of the specification Section. Identify site mobilization, bonds and insurance, and permits.
- E. Revise schedule to list approved Change Orders, with each Application For Payment.

1.03 APPLICATIONS FOR PROGRESS PAYMENTS

- A. Payment Period: Submit at intervals stipulated in the Agreement.
- B. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit sample to Architect for approval.
- C. Forms filled out by hand will not be accepted.
- D. For each item, provide a column for listing each of the following:
 - 1. Item Number.
 - 2. Description of work.
 - 3. Scheduled Values.
 - 4. Previous Applications.
 - 5. Work in Place and Stored Materials under this Application.
 - 6. Authorized Change Orders.
 - 7. Total Completed and Stored to Date of Application.
 - 8. Percentage of Completion.
 - 9. Balance to Finish.
 - 10. Retainage.
- E. Execute certification by signature of authorized officer.
- F. Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of work performed and for stored products.
- G. List each authorized Change Order as a separate line item, listing Change Order number and dollar amount as for an original item of Work.
- H. Submit one digital copies of each Application for Payment.
- I. When Architect requires substantiating information, submit data justifying dollar amounts in question. Provide one copy of data with cover letter for each copy of submittal. Show application number and date, and line item by number and description.

1.04 MODIFICATION PROCEDURES

- A. For minor changes not involving an adjustment to the Contract Sum or Contract Time, Architect will issue instructions directly to Contractor.

- B. For other required changes, Architect will issue a document signed by Owner instructing Contractor to proceed with the change, for subsequent inclusion in a Change Order.
 - 1. The document will describe the required changes and will designate method of determining any change in Contract Sum or Contract Time.
 - 2. Promptly execute the change.
- C. For changes for which advance pricing is desired, Architect will issue a document that includes a detailed description of a proposed change with supplementary or revised drawings and specifications, a change in Contract Time for executing the change with a stipulation of any overtime work required and the period of time during which the requested price will be considered valid. Contractor shall prepare and submit a fixed price quotation within ____ days.
- D. Contractor may propose a change by submitting a request for change to Architect, describing the proposed change and its full effect on the Work, with a statement describing the reason for the change, and the effect on the Contract Sum and Contract Time with full documentation and a statement describing the effect on Work by separate or other contractors. Document any requested substitutions in accordance with Section 01 6000.
- E. Computation of Change in Contract Amount: As specified in the Agreement and Conditions of the Contract.
 - 1. For change requested by Architect for work falling under a fixed price contract, the amount will be based on Contractor's price quotation.
 - 2. For change requested by Contractor, the amount will be based on the Contractor's request for a Change Order as approved by Architect.
 - 3. For change ordered by Architect without a quotation from Contractor, the amount will be determined by Architect based on the Contractor's substantiation of costs as specified for Time and Material work.
- F. Substantiation of Costs: Provide full information required for evaluation.
 - 1. On request, provide the following data:
 - a. Quantities of products, labor, and equipment.
 - b. Taxes, insurance, and bonds.
 - c. Overhead and profit.
 - d. Justification for any change in Contract Time.
 - e. Credit for deletions from Contract, similarly documented.
 - 2. Support each claim for additional costs with additional information:
 - a. Origin and date of claim.
 - b. Dates and times work was performed, and by whom.
 - c. Time records and wage rates paid.
 - d. Invoices and receipts for products, equipment, and subcontracts, similarly documented.
 - 3. For Time and Material work, submit itemized account and supporting data after completion of change, within time limits indicated in the Conditions of the Contract.
- G. Execution of Change Orders: Architect will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.
- H. After execution of Change Order, promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Price.
- I. Promptly revise progress schedules to reflect any change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.
- J. Promptly enter changes in Project Record Documents.

1.05 APPLICATION FOR FINAL PAYMENT

- A. Prepare Application for Final Payment as specified for progress payments, identifying total adjusted Contract Price, previous payments, and sum remaining due.
- B. Application for Final Payment will not be considered until the following have been accomplished:

1. All closeout procedures specified in Section 01 7000.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

**SECTION 01 2100
ALLOWANCES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Cash allowances.
- B. Inspecting and testing allowances.

1.02 RELATED REQUIREMENTS

- A. Section 01 2000 - Price and Payment Procedures: Additional payment and modification procedures.

1.03 CASH ALLOWANCES

- A. Costs Included in Cash Allowances: Cost of product to Contractor or subcontractor, less applicable trade discounts.
- B. Costs Not Included in Cash Allowances: Product delivery to site and handling at the site, including unloading, uncrating, and storage; protection of products from elements and from damage; and labor for installation and finishing. _____.
- C. Architect Responsibilities:
 - 1. Consult with Contractor for consideration and selection of products, suppliers, and installers.
 - 2. Select products in consultation with Owner and transmit decision to Contractor.
- D. Contractor Responsibilities:
 - 1. Assist Architect in selection of products, suppliers, and installers.
 - 2. Obtain proposals from suppliers and installers and offer recommendations.
 - 3. On notification of which products have been selected, execute purchase agreement with designated supplier and installer.
 - 4. Arrange for and process shop drawings, product data, and samples. Arrange for delivery.
 - 5. Promptly inspect products upon delivery for completeness, damage, and defects. Submit claims for transportation damage.
- E. Differences in costs will be adjusted by Change Order.

1.04 INSPECTING AND TESTING ALLOWANCES

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

1.05 ALLOWANCES SCHEDULE

- A. Inspecting and Testing Allowance: Include the sum of \$10,500.00 for payment of inspecting services specified in Section 01 4000 - Quality Requirements and as required by authorities having jurisdiction including but not limited to Structural Steel, Framing and Grout inspections.
- B. Soils Testing Allowance: Include the sum of \$28,000.00 for testing compacted soils, site concrete and site asphalt as specified in Stahly Engineering Proposal.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

**SECTION 01 2300
ALTERNATES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Description of Alternates.
- B. Procedures for pricing Alternates.

1.02 ACCEPTANCE OF ALTERNATES

- A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at Owner's option. Accepted Alternates will be identified in the Owner-Contractor Agreement.
- B. Coordinate related work and modify surrounding work to integrate the Work of each Alternate.

1.03 SCHEDULE OF ALTERNATES

- A. Alternate No. 1 - ADD Smokers Hut:
 - 1. Provide all materials, services and labor necessary to complete the construction of the smokers hut as indicated on the architectural site plan and associated details. This alternate should also include the costs associated with reducing the landscaping and irrigation in the location of the smokers hut.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 3000
ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Preconstruction meeting.
- B. Site mobilization meeting.
- C. Progress meetings.
- D. Construction progress schedule.
- E. Submittals for review, information, and project closeout.
- F. Submittal procedures.

1.02 RELATED REQUIREMENTS

- A. Section 01 7000 - Execution and Closeout Requirements: Additional coordination requirements.
- B. Section 01 7800 - Closeout Submittals: Project record documents.

1.03 PROJECT COORDINATION

- A. Project Coordinator: Construction Manager.
- B. Cooperate with the Project Coordinator in allocation of mobilization areas of site; for field offices and sheds, for owner, contractor and subcontractor access, traffic, and parking facilities.
- C. During construction, coordinate use of site and facilities through the Project Coordinator.
- D. Comply with Project Coordinator's procedures for intra-project communications; submittals, reports and records, schedules, coordination drawings, and recommendations; and resolution of ambiguities and conflicts.
- E. Comply with instructions of the Project Coordinator for use of temporary utilities and construction facilities.
- F. Coordinate field engineering and layout work under instructions of the Project Coordinator.
- G. Make the following types of submittals to Architect through the Project Coordinator:
 - 1. Requests for interpretation.
 - 2. Requests for substitution.
 - 3. Shop drawings, product data, and samples.
 - 4. Test and inspection reports.
 - 5. Manufacturer's instructions and field reports.
 - 6. Applications for payment and change order requests.
 - 7. Progress schedules.
 - 8. Coordination drawings.
 - 9. Closeout submittals.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRECONSTRUCTION MEETING

- A. Project Coordinator will schedule a meeting after Notice of Award.
- B. Attendance Required:
 - 1. Owner.
 - 2. Architect.
 - 3. Contractor.
- C. Agenda:
 - 1. Execution of Owner-Contractor Agreement.
 - 2. Submission of executed bonds and insurance certificates.
 - 3. Distribution of Contract Documents.

4. Submission of list of Subcontractors, list of Products, schedule of values, and progress schedule.
 5. Designation of personnel representing the parties to Contract, _____ and Architect.
 6. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
 7. Scheduling.
- D. Record minutes and distribute copies within two days after meeting to participants, with copies to Architect, Owner, participants, and those affected by decisions made.

3.02 SITE MOBILIZATION MEETING

- A. Project Coordinator will schedule meeting at the Project site prior to Contractor occupancy.
- B. Attendance Required:
1. Contractor.
 2. Owner.
 3. Architect.
 4. Contractor's Superintendent.
 5. Major Subcontractors.
- C. Agenda:
1. Use of premises by Owner and Contractor.
 2. Owner's requirements and occupancy prior to completion.
 3. Construction facilities and controls provided by Owner.
 4. Temporary utilities provided by Owner.
 5. Survey and building layout.
 6. Security and housekeeping procedures.
 7. Schedules.
 8. Application for payment procedures.
 9. Procedures for testing.
 10. Procedures for maintaining record documents.
 11. Requirements for start-up of equipment.
 12. Inspection and acceptance of equipment put into service during construction period.
- D. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.03 PROGRESS MEETINGS

- A. Schedule and administer meetings throughout progress of the Work at maximum monthly intervals.
- B. Project Coordinator will make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.
- C. Attendance Required:
1. Contractor.
 2. Owner.
 3. Architect.
 4. Contractor's Superintendent.
 5. Major Subcontractors.
- D. Agenda:
1. Review minutes of previous meetings.
 2. Review of Work progress.
 3. Field observations, problems, and decisions.
 4. Identification of problems that impede, or will impede, planned progress.
 5. Review of submittals schedule and status of submittals.
 6. Maintenance of progress schedule.
 7. Corrective measures to regain projected schedules.
 8. Planned progress during succeeding work period.

9. Maintenance of quality and work standards.
 10. Effect of proposed changes on progress schedule and coordination.
 11. Other business relating to Work.
- E. Record minutes and distribute copies within two days after meeting to participants, with copies to Architect, Owner, participants, and those affected by decisions made.

3.04 CONSTRUCTION PROGRESS SCHEDULE

- A. Within 10 days after date of the Agreement, submit preliminary schedule defining planned operations for the first 60 days of Work, with a general outline for remainder of Work.
- B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.
- C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
 1. Include written certification that major contractors have reviewed and accepted proposed schedule.
- D. Within 10 days after joint review, submit complete schedule.
- E. Submit updated schedule with each Application for Payment.

3.05 SUBMITTALS FOR REVIEW

- A. When the following are specified in individual sections, submit them for review:
 1. Product data.
 2. Shop drawings.
 3. Samples for selection.
 4. Samples for verification.
- B. Submit to Architect for review for the limited purpose of checking for conformance with information given and the design concept expressed in the contract documents.
- C. Samples will be reviewed only for aesthetic, color, or finish selection.
- D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 01 7800 - Closeout Submittals.

3.06 SUBMITTALS FOR INFORMATION

- A. When the following are specified in individual sections, submit them for information:
 1. Design data.
 2. Certificates.
 3. Test reports.
 4. Inspection reports.
 5. Manufacturer's instructions.
 6. Manufacturer's field reports.
 7. Other types indicated.
- B. Submit for Architect's knowledge as contract administrator or for Owner. No action will be taken.

3.07 SUBMITTALS FOR PROJECT CLOSEOUT

- A. Submit Correction Punch List for Substantial Completion.
- B. Submit Final Correction Punch List for Substantial Completion.
- C. When the following are specified in individual sections, submit them at project closeout:
 1. Project record documents.
 2. Operation and maintenance data.
 3. Warranties.
 4. Bonds.
 5. Other types as indicated.
- D. Submit for Owner's benefit during and after project completion.

3.08 NUMBER OF COPIES OF SUBMITTALS

- A. Electronic Documents: Submit one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.
- B. Samples: Submit the number specified in individual specification sections; one of which will be retained by Architect.
 - 1. After review, produce duplicates.
 - 2. Retained samples will not be returned to Contractor unless specifically so stated.

3.09 SUBMITTAL PROCEDURES

- A. Shop Drawing Procedures:
 - 1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting the Contract Documents and coordinating related Work.
 - 2. Generic, non-project specific information submitted as shop drawings do not meet the requirements for shop drawings.
- B. Transmit each submittal with a copy of approved submittal form.
- C. Sequentially number the transmittal form. Revise submittals with original number and a sequential alphabetic suffix.
- D. Identify Project, Contractor, Subcontractor or supplier; pertinent drawing and detail number, and specification section number, as appropriate on each copy.
- E. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of Products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with the requirements of the Work and Contract Documents.
- F. Deliver submittals to Architect at business address.
- G. Schedule submittals to expedite the Project, and coordinate submission of related items.
- H. For each submittal for review, allow 15 days excluding delivery time to and from the Contractor.
- I. Identify variations from Contract Documents and Product or system limitations that may be detrimental to successful performance of the completed Work.
- J. Provide space for Contractor and Architect review stamps.
- K. When revised for resubmission, identify all changes made since previous submission.
- L. Distribute reviewed submittals as appropriate. Instruct parties to promptly report any inability to comply with requirements.
- M. Submittals not requested will not be recognized or processed.

END OF SECTION

SECTION 01 3216
CONSTRUCTION PROGRESS SCHEDULE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Preliminary schedule.
- B. Construction progress schedule, bar chart type.

1.02 RELATED SECTIONS

- A. Section 01 1000 - Summary: Work sequence.

1.03 REFERENCES

- A. AGC (CPSM) - Construction Planning and Scheduling Manual; 2004.
- B. M-H (CPM) - CPM in Construction Management - Project Management with CPM; O'Brien; 2006.

1.04 SUBMITTALS

- A. Within 10 days after date of Agreement, submit preliminary schedule defining planned operations for the first 60 days of Work, with a general outline for remainder of Work.
- B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.
- C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
 - 1. Include written certification that major contractors have reviewed and accepted proposed schedule.
- D. Within 10 days after joint review, submit complete schedule.
- E. Submit the number of opaque reproductions that Contractor requires, plus two copies that will be retained by Architect.

1.05 SCHEDULE FORMAT

- A. Listings: In chronological order according to the start date for each activity. Identify each activity with the applicable specification section number.
- B. Sheet Size: Multiples of 8-1/2 x 11 inches (216 x 280 mm).
- C. Scale and Spacing: To allow for notations and revisions.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRELIMINARY SCHEDULE

- A. Prepare preliminary schedule in the form of a horizontal bar chart.

3.02 BAR CHARTS

- A. Include a separate bar for each major portion of Work or operation.
- B. Identify the first work day of each week.

3.03 REVIEW AND EVALUATION OF SCHEDULE

- A. Participate in joint review and evaluation of schedule with Architect at each submittal.
- B. Evaluate project status to determine work behind schedule and work ahead of schedule.
- C. After review, revise as necessary as result of review, and resubmit within 10 days.

3.04 UPDATING SCHEDULE

- A. Maintain schedules to record actual start and finish dates of completed activities.
- B. Indicate progress of each activity to date of revision, with projected completion date of each activity.

- C. Annotate diagrams to graphically depict current status of Work.
- D. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.
- E. Indicate changes required to maintain Date of Substantial Completion.
- F. Submit reports required to support recommended changes.

3.05 DISTRIBUTION OF SCHEDULE

- A. Distribute copies of updated schedules to Contractor's project site file, to Subcontractors, suppliers, Architect, Owner, and other concerned parties.
- B. Instruct recipients to promptly report, in writing, problems anticipated by projections shown in schedules.

END OF SECTION

SECTION 01 4000
QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. References and standards.
- B. Testing and inspection agencies and services.
- C. Control of installation.
- D. Mock-ups.
- E. Tolerances.
- F. Manufacturers' field services.

1.02 RELATED REQUIREMENTS

- A. Section 01 2100 - Allowances: Allowance for payment of testing services.
- B. Section 01 3000 - Administrative Requirements: Submittal procedures.
- C. Section 01 6000 - Product Requirements: Requirements for material and product quality.

1.03 REFERENCE STANDARDS

- A. ASTM C1021 - Standard Practice for Laboratories Engaged in Testing of Building Sealants; 2008 (Reapproved 2014).
- B. ASTM C1077 - Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation; 2014.
- C. ASTM C1093 - Standard Practice for Accreditation of Testing Agencies for Masonry; 2013.
- D. ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction; 2012a.
- E. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection; 2014a.
- F. ASTM E543 - Standard Specification for Agencies Performing Nondestructive Testing; 2013.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Test Reports: After each test/inspection, promptly submit electronic copies of report to Architect and to Contractor.
 - 1. Include:
 - a. Date issued.
 - b. Project title and number.
 - c. Name of inspector.
 - d. Date and time of sampling or inspection.
 - e. Identification of product and specifications section.
 - f. Location in the Project.
 - g. Type of test/inspection.
 - h. Date of test/inspection.
 - i. Results of test/inspection.
 - j. Conformance with Contract Documents.
 - k. When requested by Architect, provide interpretation of results.
- C. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to Architect, in quantities specified for Product Data.
 - 1. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

2. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect.
- D. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Owner's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.
- E. Manufacturer's Field Reports: Submit reports for Architect's benefit as contract administrator or for Owner.
 1. Submit for information for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents.

1.05 REFERENCES AND STANDARDS

- A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- B. Conform to reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.
- C. Obtain copies of standards where required by product specification sections.
- D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.
- E. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.
- F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of Architect shall be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.06 TESTING AND INSPECTION AGENCIES AND SERVICES

- A. Owner will employ services of an independent testing agency to perform certain specified testing; payment for cost of services will be derived from allowance specified in Section 01 2100; see Section 01 2100 and applicable sections for description of services included in allowance.
- B. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.
- C. Contractor Employed Agency:
 1. Testing agency: Comply with requirements of ASTM E329, ASTM E543, ASTM C1021, ASTM C1077, ASTM C1093, and ASTM D3740.
 2. Inspection agency: Comply with requirements of ASTM D3740 and ASTM E329.
 3. Laboratory Staff: Maintain a full time registered Engineer on staff to review services.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CONTROL OF INSTALLATION

- A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.
- B. Comply with manufacturers' instructions, including each step in sequence.
- C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.
- D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Have Work performed by persons qualified to produce required and specified quality.

- F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.
- G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

3.02 MOCK-UPS

- A. Tests shall be performed under provisions identified in this section and identified in the respective product specification sections.
- B. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.
- C. Accepted mock-ups shall be a comparison standard for the remaining Work.
- D. Where mock-up has been accepted by Architect and is specified in product specification sections to be removed, protect mock-up throughout construction, remove mock-up and clear area when directed to do so by Architect.

3.03 TOLERANCES

- A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.
- B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.
- C. Adjust products to appropriate dimensions; position before securing products in place.

3.04 TESTING AND INSPECTION

- A. See individual specification sections for testing and inspection required.
- B. Testing Agency Duties:
 - 1. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
 - 2. Perform specified sampling and testing of products in accordance with specified standards.
 - 3. Ascertain compliance of materials and mixes with requirements of Contract Documents.
 - 4. Promptly notify Architect and Contractor of observed irregularities or non-conformance of Work or products.
 - 5. Perform additional tests and inspections required by Architect.
 - 6. Submit reports of all tests/inspections specified.
- C. Limits on Testing/Inspection Agency Authority:
 - 1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
 - 2. Agency may not approve or accept any portion of the Work.
 - 3. Agency may not assume any duties of Contractor.
 - 4. Agency has no authority to stop the Work.
- D. Contractor Responsibilities:
 - 1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
 - 2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
 - 3. Provide incidental labor and facilities:
 - a. To provide access to Work to be tested/inspected.
 - b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
 - c. To facilitate tests/inspections.
 - d. To provide storage and curing of test samples.
 - 4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.

- 5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
- 6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
- E. Re-testing required because of non-conformance to specified requirements shall be performed by the same agency on instructions by Architect.
- F. Re-testing required because of non-conformance to specified requirements shall be paid for by Contractor.

3.05 MANUFACTURERS' FIELD SERVICES

- A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust and balance of equipment and _____ as applicable, and to initiate instructions when necessary.
- B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3.06 DEFECT ASSESSMENT

- A. Replace Work or portions of the Work not conforming to specified requirements.
- B. If, in the opinion of Architect, it is not practical to remove and replace the Work, Architect will direct an appropriate remedy or adjust payment.

END OF SECTION

SECTION 01 5000
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Temporary utilities.
- B. Temporary telecommunications services.
- C. Temporary sanitary facilities.
- D. Temporary Controls: Barriers, enclosures, and fencing.
- E. Security requirements.
- F. Vehicular access and parking.
- G. Waste removal facilities and services.
- H. Project identification sign.
- I. Field offices.

1.02 TEMPORARY UTILITIES

- A. Provide and pay for all electrical power, lighting, water, heating and cooling, and ventilation required for construction purposes.
- B. New permanent facilities may not be used.
- C. Use trigger-operated nozzles for water hoses, to avoid waste of water.

1.03 TELECOMMUNICATIONS SERVICES

- A. Provide, maintain, and pay for telecommunications services to field office at time of project mobilization.
- B. Telecommunications services shall include:
 - 1. Internet Connections: Minimum of one; DSL modem or faster.
 - 2. Email: Account/address reserved for project use.
 - 3. Cell phone numbers for all key personnel.

1.04 TEMPORARY SANITARY FACILITIES

- A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.
- B. Maintain daily in clean and sanitary condition.

1.05 BARRIERS

- A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.
- B. Provide barricades and covered walkways required by governing authorities for public rights-of-way and for public access to existing building.
- C. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.06 FENCING

- A. Construction: Commercial grade chain link fence.
- B. Provide 6 foot (1.8 m) high fence around construction site; equip with vehicular and pedestrian gates with locks.

1.07 EXTERIOR ENCLOSURES

- A. Provide temporary insulated weather tight closure of exterior openings to accommodate acceptable working conditions and protection for Products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections,

and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.

1.08 SECURITY

- A. Provide security and facilities to protect Work, existing facilities, and Owner's operations from unauthorized entry, vandalism, or theft.

1.09 VEHICULAR ACCESS AND PARKING

- A. Coordinate access and haul routes with governing authorities and Owner.
- B. Provide and maintain access to fire hydrants, free of obstructions.
- C. Provide means of removing mud from vehicle wheels before entering streets.
- D. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.

1.10 WASTE REMOVAL

- A. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.
- B. Provide containers with lids. Remove trash from site periodically.
- C. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.
- D. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.11 PROJECT IDENTIFICATION

- A. Provide project identification sign of design, construction, and location approved by Owner.
- B. No other signs are allowed without Owner permission except those required by law.

1.12 FIELD OFFICES

- A. Office: Weathertight, with lighting, electrical outlets, heating, cooling equipment, and equipped with sturdy furniture, drawing rack and drawing display table.
- B. Provide space for Project meetings, with table and chairs to accommodate 6 persons.
- C. Locate offices a minimum distance of 30 feet (10 m) from existing and new structures.

1.13 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

- A. Remove temporary utilities, equipment, facilities, materials, prior to Date of Substantial Completion inspection.
- B. Remove underground installations to a minimum depth of 2 feet (600 mm). Grade site as indicated.
- C. Clean and repair damage caused by installation or use of temporary work.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 6000
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. General product requirements.
- B. Transportation, handling, storage and protection.
- C. Product option requirements.
- D. Substitution limitations and procedures.
- E. Procedures for Owner-supplied products.
- F. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 RELATED REQUIREMENTS

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

1.03 SUBMITTALS

- A. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
- B. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- C. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
 - 1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

PART 2 PRODUCTS

2.01 NEW PRODUCTS

- A. Provide new products unless specifically required or permitted by the Contract Documents.
- B. DO NOT USE products having any of the following characteristics:
 - 1. Made of wood from newly cut old growth timber.
 - 2. Containing lead, cadmium, asbestos.

2.02 PRODUCT OPTIONS

- A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.
- B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.
- C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

2.03 MAINTENANCE MATERIALS

- A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.
- B. Deliver to Project site; obtain receipt prior to final payment.

PART 3 EXECUTION

3.01 SUBSTITUTION PROCEDURES

- A. Instructions to Bidders specifies time restrictions for submitting requests for substitutions during the bidding period and the documents required. Comply with requirements specified in this section.

- B. Architect will consider requests for substitutions only within 15 days after date of Agreement.
- C. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.
- D. A request for substitution constitutes a representation that the submitter:
 - 1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
 - 2. Agrees to provide the same warranty for the substitution as for the specified product.
 - 3. Agrees to coordinate installation and make changes to other Work that may be required for the Work to be complete with no additional cost to Owner.
 - 4. Waives claims for additional costs or time extension that may subsequently become apparent.
- E. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.
- F. Substitution Submittal Procedure (after contract award):
 - 1. Submit digital copies of request for substitution for consideration. Limit each request to one proposed substitution.
 - 2. Submit shop drawings, product data, and certified test results attesting to the proposed product equivalence. Burden of proof is on proposer.
 - 3. The Architect will notify Contractor in writing of decision to accept or reject request.

3.02 OWNER-SUPPLIED PRODUCTS

- A. Owner's Responsibilities:
 - 1. Arrange for and deliver Owner reviewed shop drawings, product data, and samples, to Contractor.
 - 2. Arrange and pay for product delivery to site.
 - 3. On delivery, inspect products jointly with Contractor.
 - 4. Submit claims for transportation damage and replace damaged, defective, or deficient items.
 - 5. Arrange for manufacturers' warranties, inspections, and service.
- B. Contractor's Responsibilities:
 - 1. Review Owner reviewed shop drawings, product data, and samples.
 - 2. Receive and unload products at site; inspect for completeness or damage jointly with Owner.
 - 3. Handle, store, install and finish products.
 - 4. Repair or replace items damaged after receipt.

3.03 TRANSPORTATION AND HANDLING

- A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.
- B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.
- C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.
- D. Transport and handle products in accordance with manufacturer's instructions.
- E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.
- F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.
- G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.
- H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.04 STORAGE AND PROTECTION

- A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication.
- B. Store and protect products in accordance with manufacturers' instructions.
- C. Store with seals and labels intact and legible.
- D. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.
- E. For exterior storage of fabricated products, place on sloped supports above ground.
- F. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.
- G. Comply with manufacturer's warranty conditions, if any.
- H. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- I. Prevent contact with material that may cause corrosion, discoloration, or staining.
- J. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- K. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION

SECTION 01 7000
EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Examination, preparation, and general installation procedures.
- B. Pre-installation meetings.
- C. Cutting and patching.
- D. Surveying for laying out the work.
- E. Cleaning and protection.
- F. Starting of systems and equipment.
- G. Demonstration and instruction of Owner personnel.
- H. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.
- I. General requirements for maintenance service.

1.02 RELATED REQUIREMENTS

- A. Section 01 1000 - Summary: Limitations on working in existing building; continued occupancy; work sequence; identification of salvaged and relocated materials.
- B. Section 01 3000 - Administrative Requirements: Submittals procedures, Electronic document submittal service.
- C. Section 01 4000 - Quality Requirements: Testing and inspection procedures.
- D. Section 01 5000 - Temporary Facilities and Controls: Temporary exterior enclosures.
- E. Section 01 7800 - Closeout Submittals: Project record documents, operation and maintenance data, warranties and bonds.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Survey work: Submit name, address, and telephone number of Surveyor before starting survey work.
 - 1. On request, submit documentation verifying accuracy of survey work.
 - 2. Submit a copy of site drawing signed by the Land Surveyor, that the elevations and locations of the work are in conformance with Contract Documents.
 - 3. Submit surveys and survey logs for the project record.
- C. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
 - 1. Structural integrity of any element of Project.
 - 2. Integrity of weather exposed or moisture resistant element.
 - 3. Efficiency, maintenance, or safety of any operational element.
 - 4. Visual qualities of sight exposed elements.
 - 5. Work of Owner or separate Contractor.
 - 6. Include in request:
 - a. Identification of Project.
 - b. Location and description of affected work.
 - c. Necessity for cutting or alteration.
 - d. Description of proposed work and products to be used.
 - e. Effect on work of Owner or separate Contractor.
 - f. Date and time work will be executed.
- D. Project Record Documents: Accurately record actual locations of capped and active utilities.

1.04 PROJECT CONDITIONS

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

- B. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.
- C. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
- D. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.
- E. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.
 - 1. Minimize amount of bare soil exposed at one time.
 - 2. Provide temporary measures such as berms, dikes, and drains, to prevent water flow.
 - 3. Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.
 - 4. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.
- F. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.

1.05 COORDINATION

- A. See Section 01 1000 for occupancy-related requirements.
- B. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
- C. Notify affected utility companies and comply with their requirements.
- D. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
- E. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- F. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
- G. Coordinate completion and clean-up of work of separate sections.
- H. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

PART 2 PRODUCTS

2.01 PATCHING MATERIALS

- A. New Materials: As specified in product sections; match existing products and work for patching and extending work.
- B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.
- C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

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

- B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.
- C. Examine and verify specific conditions described in individual specification sections.
- D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.
- E. Verify that utility services are available, of the correct characteristics, and in the correct locations.
- F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.02 PREPARATION

- A. Clean substrate surfaces prior to applying next material or substance.
- B. Seal cracks or openings of substrate prior to applying next material or substance.
- C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.03 PREINSTALLATION MEETINGS

- A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section.
- B. Require attendance of parties directly affecting, or affected by, work of the specific section.
- C. Notify Architect four days in advance of meeting date.
- D. Prepare agenda and preside at meeting:
 - 1. Review conditions of examination, preparation and installation procedures.
 - 2. Review coordination with related work.
- E. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.04 LAYING OUT THE WORK

- A. Verify locations of survey control points prior to starting work.
- B. Promptly notify Architect of any discrepancies discovered.
- C. Protect survey control points prior to starting site work; preserve permanent reference points during construction.
- D. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.
- E. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.
- F. Utilize recognized engineering survey practices.
- G. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
 - 1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations; and _____.
 - 2. Grid or axis for structures.
 - 3. Building foundation, column locations, ground floor elevations, and _____.
- H. Periodically verify layouts by same means.
- I. Maintain a complete and accurate log of control and survey work as it progresses.

3.05 GENERAL INSTALLATION REQUIREMENTS

- A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.
- B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.
- C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.
- D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.
- E. Make neat transitions between different surfaces, maintaining texture and appearance.

3.06 CUTTING AND PATCHING

- A. Whenever possible, execute the work by methods that avoid cutting or patching.
- B. Perform whatever cutting and patching is necessary to:
 - 1. Complete the work.
 - 2. Fit products together to integrate with other work.
 - 3. Provide openings for penetration of mechanical, electrical, and other services.
 - 4. Match work that has been cut to adjacent work.
 - 5. Repair areas adjacent to cuts to required condition.
 - 6. Repair new work damaged by subsequent work.
 - 7. Remove samples of installed work for testing when requested.
 - 8. Remove and replace defective and non-conforming work.
- C. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.
- D. Employ skilled and experienced installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.
- E. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.
- F. Restore work with new products in accordance with requirements of Contract Documents.
- G. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- H. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 8400, to full thickness of the penetrated element.
- I. Patching:
 - 1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
 - 2. Match color, texture, and appearance.
 - 3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

3.07 PROGRESS CLEANING

- A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
- B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.
- C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.
- D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

3.08 PROTECTION OF INSTALLED WORK

- A. Protect installed work from damage by construction operations.
- B. Provide special protection where specified in individual specification sections.
- C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
- D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
- E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
- F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
- G. Prohibit traffic from landscaped areas.
- H. Remove protective coverings when no longer needed; reuse or recycle plastic coverings if possible.

3.09 SYSTEM STARTUP

- A. Coordinate schedule for start-up of various equipment and systems.
- B. Notify Architect and owner seven days prior to start-up of each item.
- C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.
- D. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
- E. Verify that wiring and support components for equipment are complete and tested.
- F. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.
- G. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.
- H. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.10 DEMONSTRATION AND INSTRUCTION

- A. Demonstrate operation and maintenance of products to Owner's personnel two weeks prior to date of Substantial Completion.
- B. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at scheduled time, at equipment location.
- C. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.
- D. Provide a qualified person who is knowledgeable about the Project to perform demonstration and instruction of owner personnel.
- E. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance.
- F. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

3.11 ADJUSTING

- A. Adjust operating products and equipment to ensure smooth and unhindered operation.
- B. Testing, adjusting, and balancing HVAC systems: See Section 23 0593 - Testing, Adjusting, and Balancing for HVAC.

3.12 FINAL CLEANING

- A. Execute final cleaning prior to final project assessment.
 - 1. Clean areas to be occupied by Owner prior to final completion before Owner occupancy.
- B. Use cleaning materials that are nonhazardous.
- C. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.
- D. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.
- E. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.
- F. Clean filters of operating equipment.
- G. Clean debris from roofs, gutters, downspouts, scuppers, overflow drains, area drains, and drainage systems.
- H. Clean site; sweep paved areas, rake clean landscaped surfaces.
- I. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.13 CLOSEOUT PROCEDURES

- A. Make submittals that are required by governing or other authorities.
 - 1. Provide copies to Architect and Owner.
- B. Accompany Project Coordinator on preliminary inspection to determine items to be listed for completion or correction in the Contractor's Correction Punch List for Contractor's Notice of Substantial Completion.
- C. Notify Architect when work is considered ready for Architect's Substantial Completion inspection.
- D. Submit written certification containing Contractor's Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's Substantial Completion inspection.
- E. Conduct Substantial Completion inspection and create Final Correction Punch List containing Architect's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Architect.
- F. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.
- G. Notify Architect when work is considered finally complete and ready for Architect's Substantial Completion final inspection.
- H. Complete items of work determined by Architect listed in executed Certificate of Substantial Completion.

3.14 MAINTENANCE

- A. Provide service and maintenance of components indicated in specification sections.
- B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than one year from the Date of Substantial Completion or the length of the specified warranty, whichever is longer.
- C. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.
- D. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.

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

END OF SECTION

SECTION 01 7800
CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Project Record Documents.
- B. Operation and Maintenance Data.
- C. Warranties and bonds.

1.02 RELATED REQUIREMENTS

- A. Section 01 3000 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.
- B. Section 01 7000 - Execution and Closeout Requirements: Contract closeout procedures.
- C. Individual Product Sections: Specific requirements for operation and maintenance data.
- D. Individual Product Sections: Warranties required for specific products or Work.

1.03 SUBMITTALS

- A. Project Record Documents: Submit documents to Architect with claim for final Application for Payment.
- B. Operation and Maintenance Data:
 - 1. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Architect will review draft and return one copy with comments.
 - 2. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
 - 3. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.
 - 4. Submit two sets of revised final documents in final form within 10 days after final inspection.
- C. Warranties and Bonds:
 - 1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
 - 2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
 - 3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT RECORD DOCUMENTS

- A. Maintain on site one set of the following record documents; record actual revisions to the Work:
 - 1. Drawings.
 - 2. Specifications.
 - 3. Addenda.
 - 4. Change Orders and other modifications to the Contract.
 - 5. Reviewed shop drawings, product data, and samples.
 - 6. Manufacturer's instruction for assembly, installation, and adjusting.
- B. Ensure entries are complete and accurate, enabling future reference by Owner.
- C. Store record documents separate from documents used for construction.
- D. Record information concurrent with construction progress.

- E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
 - 1. Manufacturer's name and product model and number.
 - 2. Product substitutions or alternates utilized.
 - 3. Changes made by Addenda and modifications.
- F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
 - 1. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - 2. Field changes of dimension and detail.
 - 3. Details not on original Contract drawings.

3.02 OPERATION AND MAINTENANCE DATA

- A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.
- B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
- C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.
- D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

- A. For Each Product, Applied Material, and Finish:
 - 1. Product data, with catalog number, size, composition, and color and texture designations.
 - 2. Information for re-ordering custom manufactured products.
- B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.
- C. Moisture protection and weather-exposed products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.
- D. Additional information as specified in individual product specification sections.
- E. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

- A. For Each Item of Equipment and Each System:
 - 1. Description of unit or system, and component parts.
 - 2. Identify function, normal operating characteristics, and limiting conditions.
 - 3. Include performance curves, with engineering data and tests.
 - 4. Complete nomenclature and model number of replaceable parts.
- B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.
- C. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

- D. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- E. Provide servicing and lubrication schedule, and list of lubricants required.
- F. Include manufacturer's printed operation and maintenance instructions.
- G. Include sequence of operation by controls manufacturer.
- H. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- I. Include test and balancing reports.
- J. Additional Requirements: As specified in individual product specification sections.

3.05 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

- A. Assemble operation and maintenance data into durable manuals for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.
- B. Where systems involve more than one specification section, provide separate tabbed divider for each system.
- C. Binders: Commercial quality, 8-1/2 by 11 inch (216 by 280 mm) three D side ring binders with durable plastic covers; 2 inch (50 mm) maximum ring size. When multiple binders are used, correlate data into related consistent groupings.
- D. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.
- E. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants, Contractor and subcontractors, with names of responsible parties.
- F. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.
- G. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.
- H. Text: Manufacturer's printed data, or typewritten data on 20 pound paper.
- I. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- J. Arrangement of Contents: Organize each volume in parts as follows:
 - 1. Project Directory.
 - 2. Table of Contents, of all volumes, and of this volume.
 - 3. Operation and Maintenance Data: Arranged by system, then by product category.
 - a. Source data.
 - b. Product data, shop drawings, and other submittals.
 - c. Operation and maintenance data.
 - d. Field quality control data.
 - e. Photocopies of warranties and bonds.

3.06 WARRANTIES AND BONDS

- A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.
- B. Verify that documents are in proper form, contain full information, and are notarized.
- C. Co-execute submittals when required.
- D. Retain warranties and bonds until time specified for submittal.

- E. Include photocopies of each in operation and maintenance manuals, indexed separately on Table of Contents.

END OF SECTION

SECTION 03 3000

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SECTION REQUIREMENTS

- A. Submittals: Product Data, concrete mix designs, and submittals required by ACI 301.
- B. Ready-Mixed Concrete Producer Qualifications: ASTM C 94/C 94M.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Comply with ACI 301, "Specification for Structural Concrete," and with ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

2.02 MATERIALS

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.
- B. Plain Steel Wire: ASTM A 82/A 82M, as drawn.
- C. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, as drawn, flat sheet.
- D. Portland Cement: ASTM C 150, Type I or II.
- E. Fly Ash: ASTM C 618, Class C or F.
- F. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
- G. Silica Fume: ASTM C 1240, amorphous silica.
- H. Aggregates: ASTM C 33, Class 3S coarse aggregate or better, graded.
 - 1. Maximum Coarse-Aggregate Size: 3/4 inch (19 mm) nominal.
- I. Air-Entraining Admixture: ASTM C 260.
- J. Chemical Admixtures: ASTM C 494, water reducing and accelerating. Do not use calcium chloride or admixtures containing calcium chloride.
- K. Synthetic Fiber: ASTM C 1116/C 1116M, Type III, polypropylene fibers, **NOT ALLOWED**
- L. Vapor Retarder: Reinforced sheet, ASTM E 1745, Class A.
 - 1. Contractor to submit for approval
- M. Penetrating Liquid Floor Treatments for Polished Concrete Finish: Clear, waterborne solution of inorganic silicate or silicate materials and proprietary components; odorless; that penetrates, hardens, and is suitable for polished concrete surfaces.
 - 1. Contractor to submit for approval

- N. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- O. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.
- P. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.
 - 1. Contractor to submit for approval
- Q. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.
 - 1. Contractor to submit for approval
- R. Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber, or ASTM D 1752, cork or self-expanding cork.

2.03 CONCRETE MIXTURES

- A. Prepare design mixtures, proportioned according to ACI 301.
- B. Normal-Weight Concrete:
 - 1. Minimum Compressive Strength:
 - a. Class A Concrete: 4000 psi (27.6 MPa) at 28 days.
 - b. Class B Concrete: 3000 psi (20.7 MPa) at 28 days.
 - 2. Maximum Water-Cementitious Materials Ratio:
 - a. Class A Concrete: 0.45
 - b. Class B Concrete: 0.50
 - 3. Slump Limit: 4 inches (100 mm) for concrete with verified slump of 2 to 4 inches (50 to 100 mm) before adding high-range water-reducing admixture or plasticizing admixture plus or minus 1 inch (25 mm).
 - 4. Air Content: Maintain within range permitted by ACI 301. Do not allow air content of floor slabs to receive troweled finishes to exceed 3 percent.
 - 5. Use fly ash, pozzolan, ground granulated blast-furnace slag, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent.
 - 6. For concrete exposed to deicing chemicals, limit use of fly ash to 25 percent replacement of portland cement by weight and granulated blast-furnace slag to 40 percent of portland cement by weight; silica fume to 10 percent of portland cement by weight.
- C. Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M
 - 1. When air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

EXECUTION

2.04 CONCRETING

- A. Construct formwork according to ACI 301 and maintain tolerances and surface irregularities within ACI 347R limits of Class A, 1/8 inch (3.2 mm) for concrete exposed to view and Class B, 1/4 inch (6 mm) for other concrete surfaces.
- B. Place vapor retarder on prepared subgrade, with joints lapped 6 inches (150 mm) and sealed.
- C. Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
- D. Install construction, isolation, and contraction joints where indicated. Install full-depth joint-filler strips at isolation joints.
- E. Place concrete in a continuous operation and consolidate using mechanical vibrating equipment.
- F. Protect concrete from physical damage, premature drying, and reduced strength due to hot or cold weather during mixing, placing, and curing.
- G. Formed Surface Finish: Smooth-formed finish for concrete exposed to view, coated, or covered by waterproofing or other direct-applied material; rough-formed finish elsewhere.
- H. Slab Finishes: Comply with ACI 302.1R for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces. Provide the following finishes:
 - 1. Scratch finish for surfaces to receive mortar setting beds.
 - 2. Float finish for surfaces to receive waterproofing, roofing, or other direct-applied material.
 - 3. Troweled finish for floor surfaces and floors to receive floor coverings, paint, or other thin film-finish coatings.
 - 4. Trowel and fine-broom finish for surfaces to receive thin-set tile.
 - 5. Nonslip-broom finish to exterior concrete platforms, steps, and ramps.
- I. Cure formed surfaces by moisture curing for at least seven days.
- J. Begin curing concrete slabs after finishing. Apply membrane-forming curing and sealing compound to concrete.
- K. Polished Concrete Floor Treatment: Apply polished concrete finish system to cured and prepared slabs to match design reference sample.
 - 1. Machine grind floor surfaces level and smooth.
 - 2. Apply penetrating liquid floor treatment according to manufacturer's written instructions.
 - 3. Apply penetrating stain for polished concrete in polishing sequence and according to manufacturer's written instructions.
 - 4. Continue polishing with progressively finer polishing pads to gloss level required.

- 5. Neutralize and clean polished floor surfaces.
- L. Owner will engage a testing agency to perform field tests and to submit test reports.
- M. Protect concrete from damage. Repair and patch defective areas.

END OF SECTION

SECTION 03 5400
CAST UNDERLAYMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Liquid-applied self-leveling floor underlayment.
 - 1. Use gypsum-based type at 2nd, 3rd and 4th floor levels.

1.02 REFERENCE STANDARDS

- A. ASTM C472 - Standard Test Methods for Physical Testing of Gypsum, Gypsum Plasters and Gypsum Concrete; 1999 (Reapproved 2014).
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

1.03 QUALITY ASSURANCE

- A. Applicator Qualifications: Company specializing in performing the work of this section, and approved by manufacturer.

1.04 FIELD CONDITIONS

- A. Do not install underlayment until floor penetrations and peripheral work are complete.
- B. Maintain minimum ambient temperatures of 50 degrees F (10 degrees C) 24 hours before, during and 72 hours after installation of underlayment.
- C. During the curing process, ventilate spaces to remove excess moisture.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Gypsum Underlayment:
 - 1. ARDEX Engineered Cements; ARDEX GS-4: www.ardexamericas.com.
 - 2. Dependable Chemical Co., Inc; material recommended by mfr. for this application: www.floorprep.com.
 - 3. Hacker Industries, Inc; material recommended by mfr. for this application: www.hackerindustries.com.
 - 4. Maxxon Corporation; material recommended by mfr. for this application: www.maxxon.com.
 - 5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS

- A. Gypsum-Based Underlayment: Gypsum based mix, that when mixed with water in accordance with manufacturer's directions will produce self-leveling underlayment with the following properties:
 - 1. Compressive Strength: Minimum 2500 psi (17.24 MPa), tested per ASTM C472.
 - 2. Density: Maximum 115 lb/cu ft (1842 kg/cu m).
 - 3. Final Set Time: 1 to 2 hours, maximum.
 - 4. Thickness: 3/4 inch (19 mm) to maximum 7/8" inch (20 mm).
 - 5. Surface Burning Characteristics: Flame spread/Smoke developed index of 0/0 in accordance with ASTM E84.
- B. Water: Potable and not detrimental to underlayment mix materials.
- C. Primer: Manufacturer's recommended type.
- D. Joint and Crack Filler: Latex based filler, as recommended by manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate surfaces are clean, dry, unfrozen, do not contain petroleum byproducts, or other compounds detrimental to underlayment material bond to substrate.

3.02 PREPARATION

- A. Remove substrate surface irregularities. Fill voids and deck joints with filler. Finish smooth.
- B. Vacuum clean surfaces.
- C. Prime substrate in accordance with manufacturer's instructions. Allow to dry.
- D. Close floor openings.

3.03 APPLICATION

- A. Install underlayment in accordance with manufacturer's instructions.
- B. Place to indicated thickness, with top surface level to 1/8 inch in 10 ft (1:1000).

3.04 CURING

- A. Once underlayment starts to set, prohibit foot traffic until final set has been reached.
- B. Air cure in accordance with manufacturer's instructions.

3.05 PROTECTION

- A. Protect against direct sunlight, heat, and wind; prevent rapid drying to avoid shrinkage and cracking.
- B. Do not permit traffic over unprotected floor underlayment surfaces.

END OF SECTION

SECTION 04 2000

UNIT MASONRY

PART 1 GENERAL

1.1 SECTION REQUIREMENTS

- A. See Section 05 5000 "Metal Fabrications" for furnishing steel lintels for unit masonry.
- B. See Section 04 2001 "Masonry Veneer" for CMU specification.
- C. Submittals:
 - 1. Material Certificates: For each type of product indicated. Include statements of material properties indicating compliance with requirements.

PART 2 PRODUCTS

2.1 UNIT MASONRY

- A. Comply with TMS 602/ACI 530.1/ASCE 6.

2.2 MASONRY UNITS

- A. Concrete Masonry Units: ASTM C 90; Density Classification, Normal Weight.
 - 1. Special shapes for lintels, corners, jambs, sash, control joints, and other special conditions.
 - 2. Square-edged units for outside corners unless otherwise indicated.
- B. Concrete Lintels: ASTM C 1623, precast units matching concrete masonry units and with reinforcing bars indicated or required to support loads indicated.

2.3 MORTAR AND GROUT

- A. Mortar: ASTM C 270, proportion specification.
 - 1. Use portland cement-lime mortar.
 - 2. Do not use calcium chloride in mortar.
 - 3. For masonry below grade or in contact with earth, use Type M.
 - 4. For reinforced masonry, use Type S.
 - 5. For exterior, above-grade, load-bearing and nonload-bearing walls and parapet walls; for interior load-bearing walls; for interior nonload-bearing partitions, and for other applications where another type is not indicated, use Type N.
- B. Grout: ASTM C 476 with a slump of 8 to 11 inches.

2.4 REINFORCEMENT, TIES, AND ANCHORS

- A. Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60.
- B. Joint Reinforcement: ASTM A 951/A 951M.
 - 1. Coating: Mill galvanized at interior walls and hot-dip galvanized at exterior walls
 - 2. Wire Size for Side Rods: 0.148-inch diameter.
 - 3. Wire Size for Cross Rods: 0.148-inch diameter.
 - 4. For single-wythe masonry, provide either ladder design or truss design.

2.5 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded strips complying with ASTM D 1056, Grade 2A1.
- B. Preformed Control-Joint Gaskets: Designed to fit standard sash block and to maintain lateral stability in masonry wall; made from styrene-butadiene rubber or PVC.
- C. Loose-Granular Perlite Insulation: ASTM C 549, Type II or IV.
- D. Proprietary Acidic Masonry Cleaner: Product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units.

PART 3 EXECUTION

3.1 INSTALLATION, GENERAL

- A. Cut masonry units with saw. Install with cut surfaces and, where possible, cut edges concealed.
- B. Stopping and Resuming Work: Step back units; do not tooth.
- C. Fill cores in hollow concrete masonry units with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.
- D. Build nonload-bearing interior partitions full height and install compressible filler in joint between top of partition and underside of structure above.
- E. Tool exposed joints slightly concave when thumbprint hard unless otherwise indicated.
- F. Keep cavities clean of mortar droppings and other materials during construction.

3.2 LINTELS

- A. Install lintels where indicated.
- B. Minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.3 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections required by authorities having jurisdiction.
 - 1. Inspections: Level B in TMS 402/ACI 530/ASCE 5.
 - 2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.

3.4 CLEANING

- A. Clean masonry as work progresses. Remove mortar fins and smears before tooling joints.
- B. Final Cleaning: After mortar is thoroughly cured, clean exposed masonry.
 - 1. Wet wall surfaces with water before applying acidic cleaner, then remove cleaner promptly by rinsing thoroughly with clear water.
 - 2. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.

END OF SECTION

SECTION 04 2001
MASONRY VENEER

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Concrete Block.
- B. Reinforcement and Anchorage.
- C. Flashings.
- D. Installation of Lintels.
- E. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 04 2000 - Unit Masonry
- B. Section 05 5000 - Metal Fabrications: Loose steel lintels.
- C. Section 06 1000 - Rough Carpentry: Wood stud backup for masonry veneer.
- D. Section 07 9200 - Joint Sealants: Sealing control and expansion joints.

1.03 REFERENCE STANDARDS

- A. ACI 530/530.1/ERTA - Building Code Requirements and Specification for Masonry Structures and Related Commentaries; 2011.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.
- C. ASTM A580/A580M - Standard Specification for Stainless Steel Wire; 2015.
- D. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement; 2015.
- E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.
- F. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2015.
- G. ASTM B370 - Standard Specification for Copper Sheet and Strip for Building Construction; 2012.
- H. ASTM C129 - Standard Specification for Nonloadbearing Concrete Masonry Units; 2011.
- I. ASTM D226/D226M - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing; 2009.
- J. ASTM D4637/D4637M - Standard Specification for EPDM Sheet Used in Single-Ply Roof Membrane; 2013.
- K. BIA Technical Notes No. 7 - Water Penetration Resistance - Design and Detailing; 2005.
- L. BIA Technical Notes No. 28B - Brick Veneer/Steel Stud Walls; 2005.
- M. BIA Technical Notes No. 46 - Maintenance of Brick Masonry; 2005.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene one week before starting work of this section.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data for masonry units, fabricated wire reinforcement, and mortar.
- C. Samples: Submit two samples of decorative block units to illustrate color, texture, and extremes of color range.

1.06 QUALITY ASSURANCE

- A. Comply with provisions of ACI 530/530.1/ERTA, except where exceeded by requirements of the contract documents.
- B. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section with minimum five years of documented experience.
- C. Installer Qualifications: Company specializing in performing work of the type specified and with at least five years of documented experience.

1.07 MOCK-UP

- A. Construct a masonry wall as a mock-up panel sized 8 feet (2.4 m) long by 6 feet (1.8 m) high; include mortar and accessories and structural backup in mock-up.
- B. Mock-up may remain as part of the Work.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

1.09 FIELD CONDITIONS

- A. Maintain materials and surrounding air temperature to minimum 40 degrees F (5 degrees C) prior to, during, and 48 hours after completion of masonry work.
- B. Maintain materials and surrounding air temperature to maximum 90 degrees F (32 degrees C) prior to, during, and 48 hours after completion of masonry work.

PART 2 PRODUCTS

2.01 CONCRETE MASONRY UNITS

- A. Concrete Block: Comply with referenced standards and as follows:
 - 1. Size: Standard units with nominal face dimensions of 16 by 8 inches (400 by 200 mm) and nominal depth of 4 inches (100 mm).
 - 2. Special Shapes: Provide non-standard blocks configured for corners.
 - 3. Non-Loadbearing Units: ASTM C129.
 - a. Hollow block.
 - b. Manufacturer: Kanta Products in Three Forks, MT (406)285-3261.
 - c. Color: Buff.
 - d. Finish: Honed Face block with 2 coats of Prosoco Gloss 'N Guard WB block sealer.

2.02 MORTAR AND GROUT MATERIALS

- A. Mortar and Grout: As specified in Section 04 2000.

2.03 REINFORCEMENT AND ANCHORAGE

- A. Reinforcing Steel: ASTM A615/A615M, Grade 40 (40,000 psi) (280 MPa) yield strength, deformed billet bars; galvanized.
- B. Joint Reinforcement: Use ladder type joint reinforcement where vertical reinforcement is involved and truss type elsewhere, unless otherwise indicated.
- C. Joint Reinforcement: Truss type; ASTM A1064/A1064M steel wire, hot dip galvanized after fabrication to ASTM A153/A153M, Class B; 0.1483 inch (3.8 mm) side rods with 0.1483 inch (3.8 mm) cross rods; width as required to provide not more than 1 inch (25 mm) and not less than 1/2 inch (13 mm) of mortar coverage on each exposure.
 - 1. Manufacturers:
 - a. Hohmann & Barnard, Inc; HB 213 Veneer Anchor: www.h-b.com/sle.
 - b. Substitutions: See Section 01 6000 - Product Requirements.
- D. Masonry Veneer Anchors: 2-piece anchors that permit differential movement between masonry veneer and structural backup, hot dip galvanized to ASTM A153/A153M, Class B.

1. Anchor plates: Not less than 0.075 inch (1.91 mm) thick, designed for fastening to structural backup through sheathing by two fasteners; provide design with legs that penetrate sheathing and insulation to provide positive anchorage.
 2. Wire ties: Manufacturer's standard shape, 0.1875 inch (4.75 mm) thick.
 3. Vertical adjustment: Not less than 3-1/2 inches (89 mm).
 4. Seismic Feature: Provide lip, hook, or clip on end of wire ties to engage or enclose not less than one continuous horizontal joint reinforcement wire of 0.1483 inch (3.8 mm) diameter.
- E. Metal-to-Metal Fasteners: Self-drilling, self-tapping screws; corrosion resistant finish or hot dip galvanized to ASTM A153/A153M.

2.04 FLASHINGS

- A. Copper/Kraft Paper Flashings: 3 oz/sq ft (915 g/sq m) sheet copper bonded to fiber reinforced asphalt treated Kraft paper.
1. Manufacturers:
 - a. Hohmann & Barnard, Inc; Type as recommended for application: www.h-b.com/sle.
 - b. Substitutions: See Section 01 6000 - Product Requirements.
- B. EPDM Flashing: ASTM D4637/D4637, Type I, 0.040 inch (1.0 mm) thick.
1. Manufacturers:
 - a. Hohmann & Barnard, Inc; Type as recommended for application: www.h-b.com/sle.
 - b. Substitutions: See Section 01 6000 - Product Requirements.
- C. Pre-Coated Galvanized Steel: ASTM A653/A653M, with G90/Z275 coating, 24 gage, 0.0239 inch (0.61 mm) base metal thickness, shop precoated with fluoropolymer coating in color matching masonry.
- D. Flashing Sealant/Adhesives: Silicone, polyurethane, or silyl-terminated polyether/polyurethane, or other type required or recommended by flashing manufacturer; type capable of adhering to type of flashing used.

2.05 ACCESSORIES

- A. Preformed Control Joints: Neoprene material. Provide with corner and tee accessories, fused joints.
1. Manufacturers:
 - a. Blok-Lok Limited; Type recommended for application: www.blok-lok.com.
 - b. Hohmann & Barnard, Inc; Type recommended for application: www.h-b.com/sle.
 - c. WIRE-BOND; Type recommended for application: www.wirebond.com.
 - d. Substitutions: See Section 01 6000 - Product Requirements.
- B. Joint Filler: Closed cell polyvinyl chloride; oversized 50 percent to joint width; self expanding; 3 inch (____ mm) wide by maximum lengths available.
1. Manufacturers:
 - a. Hohmann & Barnard, Inc; Type recommended for application: www.h-b.com/sle.
 - b. WIRE-BOND; Type recommended for application: www.wirebond.com.
 - c. Dur-O-Wal; Type recommended for application; www.dur-o-wal.com.
 - d. Substitutions: See Section 01 6000 - Product Requirements.
- C. Building Paper: ASTM D226/D226M, Type I ("No. 15") asphalt felt.
- D. Weeps: Polyethylene tubing.
1. Manufacturers:
 - a. Blok-Lok Limited; Type recommended for application: www.blok-lok.com.
 - b. Hohmann & Barnard, Inc; Type recommended for application: www.h-b.com/sle.
 - c. WIRE-BOND; Type recommended for application: www.wirebond.com.
 - d. Substitutions: See Section 01 6000 - Product Requirements.
- E. Cavity Mortar Control: Semi-rigid polyethylene or polyester mesh panels, sized to thickness of wall cavity, and designed to prevent mortar droppings from clogging weeps and cavity vents and allow proper cavity drainage.
1. Mortar Diverter: Panels installed at flashing locations.

- F. Termination Bars: Stainless steel; compatible with membrane and adhesives.
- G. Drip Edge: Stainless steel; compatible with membrane and adhesives.
- H. Lap Sealants and Tapes: As recommended by flashing manufacturer; compatible with membrane and adhesives.
- I. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive masonry.
- B. Verify that related items provided under other sections are properly sized and located.
- C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.02 COURSING

- A. Establish lines, levels, and coursing indicated. Protect from displacement.
- B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
- C. Concrete Masonry Units:
 - 1. Bond: Running.
 - 2. Coursing: One unit and one mortar joint to equal 8 inches (200 mm).
 - 3. Mortar Joints: Concave.

3.03 PLACING AND BONDING

- A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.
- B. Lay hollow masonry units with face shell bedding on head and bed joints.
- C. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.
- D. Remove excess mortar as work progresses.
- E. Interlock intersections and external corners.
- F. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.
- G. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

3.04 WEEPS/CAVITY VENTS

- A. Install weeps in veneer walls at 24 inches (600 mm) on center horizontally above through-wall flashing, above shelf angles and lintels, and at bottom of walls.
- B. Install cavity vents in veneer walls at 32 inches (800 mm) on center horizontally below shelf angles and lintels and at top of walls.

3.05 CAVITY MORTAR CONTROL

- A. Do not permit mortar to drop or accumulate into cavity air space or to plug weep/cavity vents.
- B. For cavity walls, build inner wythe ahead of outer wythe to accommodate accessories.
- C. Install cavity mortar diverter at base of cavity and at other flashing locations as recommended by manufacturer to prevent mortar droppings from blocking weep/cavity vents.

3.06 REINFORCEMENT AND ANCHORAGE - MASONRY VENEER

- A. Install horizontal joint reinforcement 16 inches (400 mm) on center.
- B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches (400 mm) each side of opening.
- C. Place continuous joint reinforcement in first and second joint below top of walls.

- D. Lap joint reinforcement ends minimum 6 inches (150 mm).
- E. Masonry Back-Up: Embed anchors to bond veneer at maximum 16 inches (400 mm) on center vertically and 36 inches (900 mm) on center horizontally. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches (200 mm) on center.
- F. Stud Back-Up: Secure veneer anchors to stud framed back-up and embed into masonry veneer at maximum 16 inches (400 mm) on center vertically and 24 inches (600 mm) on center horizontally. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches (200 mm) on center.
- G. Seismic Reinforcement: Connect veneer anchors with continuous horizontal wire reinforcement before embedding anchors in mortar.

3.07 MASONRY FLASHINGS

- A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.
 - 1. Extend flashings full width at such interruptions and at least 6 inches (152 mm) into adjacent masonry or turn up at least 8 inches (203 mm) to form watertight pan at non-masonry construction.
 - 2. Remove or cover protrusions or sharp edges that could puncture flashings.
 - 3. Seal lapped ends and penetrations of flashing before covering with mortar.
- B. Extend metal flashings to within 1/4 inch (6 mm) of exterior face of masonry.
- C. Extend plastic and EPDM flashings to within 1/4 inch (6 mm) of exterior face of masonry.
- D. Lap end joints of flashings at least 6 inches (152 mm) and seal watertight with flashing sealant/adhesive.

3.08 LINTELS

- A. Install loose steel lintels over openings.
- B. Maintain minimum 4 inch (____ mm) bearing on each side of opening.

3.09 CONTROL AND EXPANSION JOINTS

- A. Do not continue horizontal joint reinforcement through control or expansion joints.
- B. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.
- C. Size control joint in accordance with Section 07 9005 for sealant performance.

3.10 TOLERANCES

- A. Maximum Variation From Unit to Adjacent Unit: 1/16 inch (1.6 mm).
- B. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft (6 mm in 3 m) and 1/2 inch in 20 ft (13 mm in 6 m) or more.
- C. Maximum Variation from Plumb: 1/4 inch (6 mm) per story non-cumulative; 1/2 inch (13 mm) in two stories or more.
- D. Maximum Variation from Level Coursing: 1/8 inch in 3 ft (3 mm in 1 m) and 1/4 inch in 10 ft (6 mm in 3 m); 1/2 inch in 30 ft (13 mm in 9 m).
- E. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/4 inch, plus 3/8 inch (minus 6.4 mm, plus 9.5 mm).

3.11 CUTTING AND FITTING

- A. Cut and fit for pipes and conduit. Coordinate with other sections of work to provide correct size, shape, and location.
- B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.12 CLEANING

- A. Remove excess mortar and mortar smears as work progresses.
- B. Replace defective mortar. Match adjacent work.
- C. Clean soiled surfaces with cleaning solution.
- D. Use non-metallic tools in cleaning operations.

3.13 PROTECTION

- A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

END OF SECTION

SECTION 05 1200

STRUCTURAL STEEL FRAMING

PART 1 GENERAL

1.1 SECTION REQUIREMENTS

- A. Submittals: Product data, Shop Drawings, Welding Procedure Specifications (WPSs) and mill test reports.
- B. Comply with applicable provisions of the following:
 - 1. AISC 303.
 - 2. AISC 341 and AISC 341s1.
 - 3. AISC 360.
 - 4. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Connections: Provide details of connections required by the Contract Documents.

2.2 STRUCTURAL STEEL

- A. W-Shapes: ASTM A 992/A 992M Grade 50 (345).
- B. Channels, Angles, M, S-Shapes: ASTM A 36/A 36M, Grade 36.
- C. Plate and Bar: ASTM A 36/A 36M.
- D. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B, structural tubing.
- E. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B.

2.3 ACCESSORIES

- A. High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C (ASTM A 563M, Class 8S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers.
- B. Anchor Rods: ASTM F 1554, Grade 36.
 - 1. Configuration: Straight.
 - 2. Nuts: ASTM A 563 (ASTM A 563M) heavy-hex carbon steel.
 - 3. Plate Washers: ASTM A 36/A 36M carbon steel.
 - 4. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened carbon steel.

- C. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.
- D. Grout: ASTM C 1107, nonmetallic, shrinkage resistant, factory packaged.

2.4 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC 303 and AISC 360.
- B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
- C. Shop Priming: Prepare surfaces according to SSPC-SP 2 or SSPC-SP 3. Shop prime steel to a dry film thickness of at least 1.5 mils (0.038 mm). Do not prime surfaces to be embedded in concrete or mortar or to be field welded.

PART 3 EXECUTION

3.1 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
- B. Baseplates, Bearing Plates and Leveling Plates: Clean concrete and masonry surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
 - 1. Set plates for structural members on wedges, shims, or setting nuts as required.
 - 2. Weld plate washers to top of base plate.
 - 3. 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 plate before packing with grout.
 - 4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure.
- C. 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 in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
- D. Do not use thermal cutting during erection unless prior written approval obtained from Engineer of Record. Finish thermally cut sections within smoothness limits in AWS D1.1/D1.1M].
- E. 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.
- F. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

END OF SECTION

SECTION 05 5000

METAL FABRICATIONS

PART 1 GENERAL

1.1 SECTION REQUIREMENTS

- A. Submittals: Shop Drawings.

PART 2 PRODUCTS

2.1 METALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Steel Bars for Bar Gratings: ASTM A 36/A 36M or steel strip, ASTM A 1011/A 1011M or ASTM A 1018/A 1018M.
- C. Wire Rod for Bar Grating Crossbars: ASTM A 510 (ASTM A 510M).
- D. 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.
- E. Steel Tubing: ASTM A 500/A 500M.
- F. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40), black finish.
- G. Slotted Channel Framing: Cold-formed steel channels complying with MFMA-4, 1-5/8 by 1-5/8 inches (41 by 41 mm) by 0.053-inch (1.35-mm) minimum thickness, hot-dip galvanized after fabrication.
- H. Cast Iron: ASTM A 48/A 48M or ASTM A 47/A 47M.
- I. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 240/A 240M or ASTM A 666, Type 304.
- J. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.
- K. Zinc-Coated Steel Wire Rope: ASTM A 741.
 - 1. Wire-Rope Fittings: Hot-dip galvanized-steel connectors with capability to sustain, without failure, a load equal to minimum breaking strength of wire rope with which they are used.
- L. Aluminum Plate and Sheet: ASTM B 209 (ASTM B 209M), Alloy 6061-T6.
- M. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T6.
- N. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.

- O. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.
- P. Extruded-Bronze Shapes: ASTM B 455, Alloy UNS No. C38500 (architectural bronze).
- Q. Bronze Castings: ASTM B 62, Alloy UNS No. C83600 (85-5-5-5 or No. 1 composition commercial red brass) or ASTM B 584, Alloy UNS No. C86500 (No. 1 manganese bronze).

2.2 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners at exterior walls. Select fasteners for type, grade, and class required.
 - 1. Provide stainless-steel fasteners for fastening aluminum.
 - 2. Provide stainless-steel fasteners for fastening stainless steel.
 - 3. Provide bronze fasteners for fastening bronze.

2.3 GROUT

- A. Nonshrink, Nonmetallic Grout: ASTM C 1107; recommended by manufacturer for exterior applications.

2.4 FABRICATION

- A. General: Shear and punch metals cleanly and accurately. Remove burrs and ease exposed edges. Form bent-metal corners to smallest radius possible without impairing work.
- B. Welding: Weld corners and seams continuously. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals. At exposed connections, finish welds and surfaces smooth, with contour of welded surface matching those adjacent.
- C. Comply with AWS for recommended practices in shop brazing. Braze behind finished surfaces without distorting or discoloring exposed side. Clean exposed brazed joints of flux, and dress exposed and contact surfaces.
- D. On units indicated to be cast into concrete or built into masonry, provide welded-steel strap anchors, 1/8 by 1-1/2 inches (3.2 by 38 mm), with a minimum 6-inch (150-mm) embedment and 2-inch (50-mm) hook, not less than 8 inches (200 mm) from ends and corners of units and 24 inches (600 mm) o.c.
- E. Fabricate steel girders for wood frame construction from continuous steel shapes of sizes indicated.
- F. Fabricate steel pipe columns with 1/2-inch (12-mm) steel base plates and 1/4-inch (6.4-mm) steel top plates welded to pipe with continuous fillet weld same size as pipe wall thickness. Drill top plates for connection bolts and base plates for 5/8-inch (16-mm) anchor bolts.
- G. Fabricate loose lintels from steel angles and shapes. Size to provide bearing length at each side of openings equal to one-twelfth of clear span, but not less than 8 inches (200 mm).

- H. Fabricate structural-steel door frames from structural shapes and bars fully welded together, with 5/8-by-1-1/2-inch (16-by-38-mm) steel channel stops. Plug-weld built-up members and continuously weld exposed joints.
- I. Fabricate window security bars to designs indicated from steel bars and shapes of sizes and profiles indicated. Form steel bars by bending, forging, coping, mitering, and welding with full-length, full-penetration welds. Provide wall brackets, fittings, and anchors to secure units.
- J. Fabricate ladders for locations shown, complying with ANSI A14.3, welded-steel or aluminum construction.
 - 1. Submit for approval
 - 2. For elevator pit ladders, comply with ASME A17.1/CSA B44.
- K. Alternating Tread Devices: Fabricate alternating tread devices to comply with the IBC. Fabricate of open-type construction with channel or plate stringers and pipe and tube railings unless otherwise indicated. Fabricate from steel or aluminum and assemble by welding or with stainless-steel fasteners. Provide brackets and fittings for installation.
 - 1. Submit for approval
- L. Fabricated pipe bollards:
 - 1. Submit for approval.
- M. Fabricate pipe guards:
 - 1. Submit for approval
- N. Fabricate gratings according to NAAMM MBG 531. Provide **[welded]** **[pressure-locked]** gratings as follows:
 - 1. Submit for approval
- O. Fabricated nosings:
 - 1. Submit for approval
 - 2. Apply bituminous paint to concealed surfaces of units set into concrete.
- P. Fabricated treads from extruded aluminum with abrasive filler consisting of aluminum-oxide or silicon-carbide grits, or a combination of both, in an epoxy-resin binder.
 - 1. Submit for approval
 - 2. Apply clear lacquer to concealed surfaces of units set into concrete.
- Q. Fabricate column covers:
 - 1. D
 - 2. Submit for approval
- R. Fabricate lighting coves from metal of type and thickness indicated below. Coordinate size of coves, location of cutouts for electrical wiring, and method of attachment to adjoining construction.

1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
 2. Aluminum Sheet: **0.063 inch** (1.60 mm) with [**baked-enamel or powder-coat**] [**high-performance organic coating**] [**clear anodic**] [**color anodic**] finish.
 3. Steel Sheet: **0.048 inch** (1.21 mm) with [**factory-primed**] [**baked-enamel**] [**powder-coat**] finish.
- S. Fabricate pockets for window treatment from metal of type and thickness indicated below, with end closures. Coordinate dimensions and attachment methods with window treatment equipment, window frames, ceiling suspension system, and other related construction to produce a coordinated, closely fitting assembly.
1. Aluminum Sheet: **0.063 inch** (1.60 mm) with [**baked-enamel or powder-coat**] [**high-performance organic coating**] [**clear anodic**] [**color anodic**] finish.
 2. Steel Sheet: **0.048 inch** (1.21 mm) with [**factory-primed**] [**baked-enamel**] [**powder-coat**] finish.
- T. Fabricate window stools from metal of type and thickness indicated below, with end closures:
1. Aluminum Sheet: **0.063 inch** (1.60 mm) with [**baked-enamel or powder-coat**] [**high-performance organic coating**] [**clear anodic**] [**color anodic**] finish.
 2. Stainless-Steel Sheet: **0.050 inch** (1.27 mm) with [**No. 2B**] [**No. 4**] [**No. 6**] [**No. 7**] [**No. 8**] finish.
 3. Bronze Sheet: **0.051 inch** (1.29 mm) with [**buffed finish, lacquered**] [**hand-rubbed finish, lacquered**] [**statuary conversion coating over satin finish**].

2.5 STEEL AND IRON FINISHES

- A. Hot-dip galvanize steel fabrications at exterior locations.
- B. Prepare uncoated ferrous metal surfaces to comply with SSPC-SP 3 and paint with a fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Provide anchorage devices and fasteners where needed to secure items to in-place construction.
- B. Perform cutting, drilling, and fitting required for installing miscellaneous metal fabrications. Set metal fabrication accurately in location, alignment, and elevation, with edges and surfaces level, plumb, true, and free of rack.
- C. Fit exposed connections accurately together to form hairline joints or, where indicated, with uniform reveals and spaces for sealants and joint fillers.
- D. Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.
- E. Fasten security bar frames to concrete and masonry walls with cast-in-place or postinstalled anchors. Peen exposed threads of anchors to prevent removal of security bars.

- F. Install pipe guards at exposed vertical pipes where not protected by curbs or other barriers. Install by bolting to wall or column with drilled-in expansion anchors.
- G. Anchor bollards in concrete and fill solidly with concrete, mounding top surface.

END OF SECTION

SECTION 06 1000
ROUGH CARPENTRY

PART 1 GENERAL

1.1 SECTION REQUIREMENTS

- A. Submittals: ICC-ES evaluation reports for engineered wood products.

PART 2 PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

- A. Lumber: Provide dressed lumber, S4S, marked with grade stamp of inspection agency.
- B. 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: Engineered wood products shall have allowable design stresses, as published by manufacturer, that meet or exceed those indicated. Manufacturer's published values shall be demonstrated by comprehensive testing.

2.2 TREATED MATERIALS

- A. Preservative-Treated Materials: AWPA U1; Use Category UC2[.
 - 1. Use treatment containing no arsenic or chromium.
 - 2. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent.
 - 3. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
- B. Provide preservative-treated materials for items indicated on Drawings, and the following:
 - 1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
 - 2. Wood sills, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
 - 3. Wood floor plates that are installed over concrete slabs-on-grade.
- C. Fire-Retardant-Treated Materials: 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 Exterior type for exterior locations and where indicated.
 - 2. Use Interior Type A unless otherwise indicated.

3. For enclosed roof framing, framing in attic spaces, and where high-temperature fire-retardant treatment is indicated, provide material with design adjustment factors of not less than 0.85 for modulus of elasticity and 0.75 for extreme fiber in bending for Project's climatological zone.
 4. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent.
 5. Identify with appropriate classification marking of a testing and inspecting agency acceptable to authorities having jurisdiction.
- D. Provide fire-retardant treated materials for items indicated on Drawings.

2.3 FRAMING

- A. Dimension Lumber:
1. Maximum Moisture Content: 15 percent for 2-inch nominal thickness or less, 19 percent for more than 2-inch nominal thickness
 2. Non-Load-Bearing Interior Partitions: Construction, Stud, or No. 3 Western woods: WCLIB or WWPA.
 3. Framing Other Than Non-Load-Bearing Interior Partitions: See Construction Documents
 4. Exposed Framing: Provide material hand-selected for uniformity of appearance and freedom from characteristics, on exposed surfaces and edges, that would impair finish appearance, including decay, honeycomb, knot-holes, shake, splits, torn grain, and wane.
 - a. Species: As specified for framing other than non-load-bearing interior partitions.
 - b. Grade: As specified for framing other than non-load-bearing interior partitions.
- B. Timbers 5-Inch Nominal Size and Thicker: Douglas fir-larch, NLGA, WCLIB, or WWPA
1. Maximum Moisture Content: 20 percent.
- C. Laminated-Veneer Lumber: Manufactured with exterior-type adhesive complying with ASTM D 2559. Allowable design values determined according to ASTM D 5456.
1. RedBuilt, Boise, Idaho
 2. Extreme Fiber Stress in Bending, Edgewise: 2900 psi for 12-inch nominal-depth members.
 3. Modulus of Elasticity, Edgewise: 2,000,000 psi.
- D. Wood I-Joists: Prefabricated units complying with material requirements of and with structural capacities established and monitored according to ASTM D 5055.
1. RedBuilt, Boise, Idaho
 2. Web Material: Either oriented strand board or plywood, Exposure 1
 3. Structural Properties: Provide units with depths and design values not less than those indicated.
 4. Provide units complying with APA PRI-400, factory marked with nominal joist depth, joist class, span ratings, mill identification, and compliance with APA standard.
- E. 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. Material: All-veneer product.

3. Thickness: 1-1/4 inches.

2.4 MISCELLANEOUS LUMBER

- A. Miscellaneous Dimension Lumber: Standard, Stud, or No. 3 grade with 15 percent maximum moisture content of any species. Provide for nailers, blocking, and similar members.

2.5 PLYWOOD BACKING PANELS

- A. Equipment Backing Panels: Plywood, Exposure 1, C-D Plugged, fire-retardant treated, not less than 3/4-inch nominal thickness.

2.6 MISCELLANEOUS PRODUCTS

- A. Fasteners: Size and type indicated. Where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M
 1. Power-Driven Fasteners: CABO NER-272.
 2. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.
- B. Metal Framing Anchors: Structural capacity, type, and size indicated.
 1. Simpson Strong-Tie or Approved Equal
 2. Use anchors made from hot-dip galvanized steel complying with ASTM A 653/A 653M, G60 coating designation for interior locations where stainless steel is not indicated.
 3. Use anchors made from stainless steel complying with ASTM A 666, Type 304 for exterior locations and where indicated.
- C. Sill Sealer: Closed-cell neoprene foam, 1/4 inch thick.
- D. Flexible Flashing: Self-adhesive product consisting of a butyl rubber or rubberized-asphalt compound, bonded to a backing sheet to produce an overall thickness of not less than 0.025 inch.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. 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. Do not splice structural members between supports unless otherwise indicated.
- D. Securely attach rough carpentry to substrates, complying with the following:

1. CABO NER-272 for power-driven fasteners.
2. Published requirements of metal framing anchor manufacturer.
3. Table 2304.9.1, "Fastening Schedule," in the IBC.

END OF SECTION

SECTION 06 1600

SHEATHING

PART 1 GENERAL

1.1 SECTION REQUIREMENTS

- A. Submittals: ICC-ES evaluation reports for fire-retardant-treated plywood

PART 2 PRODUCTS

2.1 WOOD PANEL PRODUCTS, GENERAL

- A. Plywood: DOC PS 1.
- B. Oriented Strand Board: DOC PS 2.

2.2 TREATED PLYWOOD

- A. Preservative-Treated Plywood: AWWA U1; Use Category UC2.
 - 1. Use treatment containing no arsenic or chromium.
 - 2. Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.
- B. Provide preservative-treated plywood for items indicated on Drawings and plywood in contact with masonry or concrete or used with roofing, flashing, vapor barriers, and waterproofing.
- C. Fire-Retardant-Treated Plywood: 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 Exterior type for exterior locations and where indicated.
 - 2. Use Interior Type A unless otherwise indicated.
 - 3. 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.
 - 4. Identify with appropriate classification marking of a testing and inspecting agency acceptable to authorities having jurisdiction.
- D. Provide fire-retardant-treated plywood for items indicated on Drawings.

2.3 WALL SHEATHING

- A. Plywood Wall Sheathing: Exposure 1, Structural I sheathing.
- B. Oriented-Strand-Board Wall Sheathing: Exposure 1, Structural I sheathing.
- C. Paper-Surfaced Gypsum Wall Sheathing: ASTM C 1396/C 1396M, gypsum sheathing; with water-resistant-treated core.

- D. Glass-Mat Gypsum Wall Sheathing: ASTM C 1177/1177M.
- E. Cementitious Backer Units: ASTM C 1325, Type A.
- F. Fiberboard Wall Sheathing: AHA A194.1, Type IV, Grade 1 (Regular).
- G. Insulating Foam Wall Sheathing: One of the following:
 - 1. Extruded-Polystyrene-Foam Wall Sheathing: ASTM C 578, Type IV.
 - 2. Foil-Faced, Polyisocyanurate-Foam Wall Sheathing: ASTM C 1289, Type I or Type II, Class 2. Foam-plastic core and facings shall have flame spread of 25 or less, when tested individually.

2.4 ROOF SHEATHING

- A. Plywood Roof Sheathing: Exposure 1, Structural I sheathing.
- B. Oriented-Strand-Board Roof Sheathing: Exposure 1, Structural I sheathing.
- C. Composite Nail Base Insulated Roof Sheathing: Polyisocyanurate foam with oriented strand board laminated to one face complying with ASTM C 1289, Type V.

2.5 SUBFLOORING AND UNDERLAYMENT

- A. Subflooring:
 - 1. Plywood Subflooring: Exposure 1, Structural I single-floor panels or sheathing.
 - 2. Oriented-Strand-Board Subflooring: Exposure 1 Structural I sheathing.
- B. Underlayment:
 - 1. Plywood Underlayment for Resilient Flooring: DOC PS 1, Exposure 1 Underlayment with fully sanded face.
 - 2. Plywood Underlayment for Ceramic Tile: DOC PS 1, Exterior, C-C Plugged, not less than 5/8-inch nominal thickness, for ceramic tile set in latex-portland cement mortar.
 - 3. Plywood Underlayment for Carpet: DOC PS 1, Exposure 1, Underlayment
 - 4. Particleboard Underlayment: ANSI A208.1, Grade M-2, made with binder containing no urea formaldehyde.
 - 5. Hardboard Underlayment: AHA A135.4, Class 4 (Service), Surface S1S; with back side sanded.

2.6 MISCELLANEOUS PRODUCTS

- A. Fasteners: Size and type indicated.
 - 1. For roof[**and wall**] sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
 - 2. Power-Driven Fasteners: CABO NER-272.
- B. Sheathing Joint-and-Penetration Treatment Materials:
 - 1. Sealant for Glass-Mat Gypsum Sheathing: Silicone emulsion sealant, recommended by tape and sheathing manufacturers for application indicated.
 - 2. Sheathing Tape for Glass-Mat Gypsum Sheathing: Self-adhering, glass-fiber tape recommended by sheathing and tape manufacturers for application indicated.

3. Sheathing Tape for Foam-Plastic Sheathing: Pressure-sensitive plastic tape recommended by sheathing manufacturer for sealing joints and penetrations in sheathing.
- C. Adhesives for Field Gluing Panels to Framing: APA AFG-01.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Securely attach to substrates, complying with the following:
1. CABO NER-272 for power-driven fasteners.
 2. Table 2304.9.1, "Fastening Schedule," in the IBC
- B. Fastening Methods:
1. Subflooring:
 - a. Glue and nail to wood framing.
 - b. Screw to cold-formed metal framing.
 2. Wall and Roof Sheathing:
 - a. Nail to wood framing.
 - b. Screw to cold-formed metal framing.
 3. Underlayment:
 - a. Nail to subflooring.
- C. Glass-Mat Gypsum Sheathing Joint-and-Penetration Treatment: Seal sheathing joints and penetrations according to sheathing manufacturer's written instructions.
- D. Install cementitious backer units and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated.

END OF SECTION

SECTION 06 1753

SHOP-FABRICATED WOOD TRUSSES

PART 1 GENERAL

1.1 SECTION REQUIREMENTS

- A. Submittals: Product Data, Shop Drawings, structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation, and ICC-ES evaluation reports for metal plate connectors and metal truss accessories.
- B. Fabricator Qualifications: Shop that participates in a recognized quality-assurance program that complies with quality-control procedures in TPI 1 and that involves third-party inspection by an independent testing and inspecting agency acceptable to Architect and authorities having jurisdiction.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide metal-plate-connected wood trusses capable of withstanding design loads indicated without exceeding TPI 1 deflection limits.
- B. Comply with applicable requirements and recommendations of the following publications:
 - 1. TPI 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 BCSI, "Guide to Good Practice for Handling, Installing, Restraining & Bracing Metal Plate Connected Wood Trusses."
- C. Wood Structural Design Standard: Comply with applicable requirements in AF&PA's "National Design Specifications for Wood Construction" and its "Supplement."

2.2 MATERIALS

- A. Lumber: DOC PS 20 and applicable rules of lumber grading agencies certified by the American Lumber Standards Committee Board of Review, any species, graded visually or mechanically.
 - 1. Provide dry lumber with 15 percent maximum moisture content at time of dressing.
- B. Minimum Chord Size for Roof Trusses: 2 by 6 inches nominal for top chords
- C. Minimum Specific Gravity for Top Chords: 0.42
- D. Connector Plates: TPI 1, fabricated from hot-dip galvanized-steel sheet complying with ASTM A 653/A 653M; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G60 coating designation; and not less than 0.036 inch thick.

- E. Fasteners: Where trusses are exposed to weather or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
- F. Metal Framing Anchors: Provide framing anchors made from hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 coating designation.

2.3 FABRICATION

- A. Assemble trusses using jigs or other means to ensure uniformity and accuracy of assembly with joints closely fitted. Fabricate wood trusses within manufacturing tolerances in TPI 1.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install and brace trusses according to TPI recommendations and as indicated. Install trusses plumb, square, and true to line and securely fasten to supporting construction.
- B. Anchor trusses securely at bearing points; use metal truss tie-downs or floor truss hangers as applicable. Install fasteners through each fastener hole in metal framing anchor.
- C. Securely connect each truss ply required for forming built-up girder trusses. Anchor trusses to girder trusses.
- D. 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 bracing to comply with Section 061000 "Rough Carpentry."
 - 2. Install and fasten strongback bracing vertically against vertical web of parallel-chord floor trusses at centers indicated.
- E. Install wood trusses within installation tolerances in TPI 1.
- F. Do not alter trusses in field.
- G. Remove wood trusses that are damaged or do not meet requirements and replace with trusses that do meet requirements.

END OF SECTION

SECTION 06 1800

GLUED-LAMINATED CONSTRUCTION

PART 1 GENERAL

1.1 SECTION REQUIREMENTS

- A. Submittals: Product data, including specifications and installation instructions, ICC-ES evaluation reports for structural glued-laminated timber, and Shop Drawings showing full dimensions of each member and layout of entire structural glulam system. Show large-scale details of connections.
 - 1. Delegated-Design Submittal: Structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- B. Comply with AITC 111.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer to design structural glued-laminated timber and connectors.
- B. Structural Performance: Provide structural glulam timber capable of withstanding design loads indicated according to AITC 117 or as determined according to ASTM D 3737.

2.2 STRUCTURAL GLUED-LAMINATED TIMBER

- A. Standards: Comply with AITC A 190.1.
- B. Adhesive: Wet-use adhesive complying with AITC A190.1.
- C. Species: Douglas fir.
- D. Species and Beam Stress Classification for Beams and Purlins: Douglas fir-larch or southern pine, 24F-1.8E.
 - 1. Lay-Up: Balanced.
- E. Appearance: Architectural grade.
- F. End-Cut Sealing: After end cutting each member to final length, apply a saturation coat of end sealer to ends and other cross-cut surfaces.
- G. Seal Coat: After fabricating and sanding each unit, and end-coat sealing, apply a heavy saturation coat of penetrating sealer on surfaces of each unit.
- H. Wiped Stain Finish: Manufacturer's standard, dry-appearance, penetrating acrylic stain and sealer; oven dried and resistant to mildew and fungus.

- I. Clear Finish: Manufacturer's standard, two-coat, clear varnish finish; resistant to mildew and fungus.

2.3 CONNECTORS

- A. General: Fabricate from structural steel complying with ASTM A 36/A 36M; steel bars complying with ASTM A 575, Grade M 1020; and steel sheet complying with ASTM A 1011/A 1011M, Structural Steel, Type SS, Grade 33. Finish with rust-inhibitive primer.
- B. Beam Seats: 3/8-inch bearing plates, 3/4-inch-diameter-by-12-inch-long deformed bar anchors, and 0.239-inch side plates.
- C. Arch Base Shoes: 1-inch base plates and 3/8-inch side plates.
- D. Purlin Hangers: 0.179-inch stirrups and 0.239-inch top plates.
- E. Hinge Connectors: 0.179-inch side plates and 1-inch top and bottom plates.
- F. Tie Rods: Round steel bars with upset threads connected with forged-steel turnbuckles.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install structural glued-laminated timber for a close fit and neat appearance of joints. Carefully trim ends to fit connectors, mark and drill for bolts, and seal cuts with end sealer.
- B. Handle and temporarily support members to prevent visible surface damage. When hoisting members into place, use padded slings, and protect corners with wood blocking.
- C. Brace members as they are placed to maintain safe condition until full stability is provided.
- D. Repair damaged surfaces and finishes after completing erection.

END OF SECTION

SECTION 06 2000
FINISH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Finish carpentry items.
- B. Wood casings and moldings.
- C. Hardware and attachment accessories.

1.02 RELATED REQUIREMENTS

- A. Section 06 1000 - Rough Carpentry: Support framing, grounds, and concealed blocking.
- B. Section 06 4100 - Architectural Wood Casework: Shop fabricated custom cabinet work.
- C. Section 08 1416 - Flush Wood Doors.
- D. Section 09 9113 - Exterior Painting: Painting and finishing of finish carpentry items.
- E. Section 09 9123 - Interior Painting: Painting and finishing of finish carpentry items.

1.03 REFERENCE STANDARDS

- A. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings, Safety Performance Specifications and Methods of Test; 2010.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
- C. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.
- D. BHMA A156.9 - American National Standard for Cabinet Hardware; 2010.
- E. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood; 2009.
- F. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the work with plumbing rough-in, electrical rough-in, installation of associated and adjacent components, and owner / manager provided components.
- B. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
 - 1. Provide the information required by AWI/AWMAC/WI (AWS).
- C. Samples: Submit two samples of finish plywood, 6 x 6 inch (____x____ mm) in size illustrating wood grain and specified finish.
- D. Samples: Submit two samples of wood trim 12 inch (____ mm) long.

1.06 QUALITY ASSURANCE

- A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Protect work from moisture damage.

PART 2 PRODUCTS

2.01 FINISH CARPENTRY ITEMS

- A. Quality Grade: Unless otherwise indicated provide products of quality specified by AWI/AWMAC/WI (AWS) for Custom Grade.

- B. Exterior Woodwork Items:
 - 1. Open trellis beams at entry canopies and patio.
- C. Interior Woodwork Items:
 - 1. Moldings, Bases, Casings, and Miscellaneous Trim: Maple; prepare for transparent finish.
 - 2. Loose Shelving: Maple plywood; prepare for transparent finish.

2.02 WOOD-BASED COMPONENTS

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

2.03 LUMBER MATERIALS

- A. Hardwood Lumber: Maple species, plain sawn, maximum moisture content of 6 percent; with vertical grain, of quality suitable for transparent finish.

2.04 SHEET MATERIALS

- A. Hardwood Plywood: Face species as indicated, plain sawn, book matched, veneer core; HPVA HP-1, Front Face Grade AA, Back Face Grade 1, glue type as recommended for application.

2.05 PLASTIC LAMINATE MATERIALS

- A. Plastic Laminate: NEMA LD 3, HGS; color as selected by Architect; textured, low gloss finish; horizontal surface rated, manufacturer / color / style per Hilton Standards.

2.06 FASTENINGS

- A. Adhesive for Purposes Other Than Laminate Installation: Suitable for the purpose; not containing formaldehyde or other volatile organic compounds.
- B. Fasteners: Of size and type to suit application; chromium plated finish in concealed locations and brushed chrome or stainless steel finish in exposed locations.
- C. Concealed Joint Fasteners: Threaded steel.

2.07 ACCESSORIES

- A. Lumber for Shimming, Blocking, and concealed framing: Softwood lumber of pine or fir species.
- B. Wood edge banding; species and finish to match adjacent plywood veneer or laminate finish, width to match component thickness or as indicated on the drawings.
- C. Primer: Alkyd primer sealer.
- D. Wood Filler: Solvent base, tinted to match surface finish color.
- E. Attachment Accessories: As indicated on drawings or in Hilton Brand Standards.

2.08 HARDWARE

- A. Hardware: Comply with BHMA A156.9.

2.09 FABRICATION

- A. Shop assemble work for delivery to site, permitting passage through building openings.
- B. Cap exposed plastic laminate finish edges with material of same finish and pattern.
- C. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.
- D. Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet (600 mm) from sink cut-outs.

2.10 SHOP FINISHING

- A. Sand work smooth and set exposed nails and screws.
- B. Apply wood filler in exposed nail and screw indentations.
- C. On items to receive transparent finishes, use wood filler that matches surrounding surfaces and is of type recommended for the applicable finish.

- D. Finish work in accordance with AWI/AWMAC/WI (AWS), Section 5 - Finishing for grade specified and as follows:
 - 1. Transparent:
 - a. System - 13, Polyester, Catalyzed.
 - b. Sheen: Satin.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify adequacy of backing and support framing.
- B. Verify mechanical, electrical, and building items affecting work of this section are placed and ready to receive this work.

3.02 INSTALLATION

- A. Install work in accordance with AWI/AWMAC/WI (AWS) requirements for grade indicated.
- B. Set and secure materials and components in place, plumb and level.
- C. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch (0.79 mm). Do not use additional overlay trim to conceal larger gaps.
- D. Install components with finish nails only where absolutely necessary.
- E. Install prefinished paneling with full bed contact adhesive applied to substrate.

3.03 PREPARATION FOR SITE FINISHING

- A. Set exposed fasteners. Apply wood filler in exposed fastener indentations. Sand work smooth.
- B. Site Finishing: See Section 09 9113 and 09 9123.
- C. Before installation, prime paint surfaces of items or assemblies to be in contact with cementitious materials.

3.04 TOLERANCES

- A. Maximum Variation from True Position: 1/16 inch (1.6 mm).
- B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch (0.79 mm).

END OF SECTION

SECTION 06 4100
ARCHITECTURAL WOOD CASEWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Specially fabricated cabinet units.
- B. Countertops.
- C. Cabinet hardware.
- D. Factory finishing.

1.02 RELATED REQUIREMENTS

- A. Section 06 1000 - Rough Carpentry: Support framing, grounds, and concealed blocking.
- B. Section 09 9123 - Interior Painting: Site finishing of cabinet exterior and interior.

1.03 REFERENCE STANDARDS

- A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.
- B. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood; Hardwood Plywood & Veneer Association; 2009 (ANSI/HPVA HP-1).
- C. NEMA LD 3 - High-Pressure Decorative Laminates; National Electrical Manufacturers Association; 2005.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
 - 1. Provide the information required by AWI/AWMAC/WI (AWS).
- C. Product Data: Provide data for hardware accessories.

1.05 QUALITY ASSURANCE

- A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience and also on Hilton Brand Standards approved vendor list.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect units from moisture damage.

1.07 FIELD CONDITIONS

- A. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.

PART 2 PRODUCTS

2.01 INTERIOR FINISH SELECTIONS (FROM HILTON BRAND STYLE GUIDE)

- A. Pool and Exercise areas: Standard Prototype finishes.
- B. Lobby Area Finishes: The Oasis, Scheme 1 - By the Shore..
- C. Guest Rooms: Color Scheme C, Dark color schemed working wall.
- D. Meeting Rooms: Standard finishes per Pages 66 and 67 of the Brand Style Guide.

2.02 CABINETS

- A. Quality Grade: Unless otherwise indicated provide products of quality specified by AWI/AWMAC/WI (AWS) for Premium Grade.
- B. Wood Veneer Faced Cabinet:
 - 1. Exposed Surfaces: HPVA Grade A, Maple, plain sliced, book-matched.
 - 2. Semi-Exposed Surfaces: HPVA Grade B, Maple, plain sliced, random-matched.

- C. Plastic Laminate Faced Cabinets: Custom grade.
- D. Back of house Cabinets: Plastic laminate faced, Custom grade.
- E. All Cabinetry to be manufactured by Hilton Brand Standards approved vendor with previous experience with Home 2 Suites design, quality and finish requirements.

2.03 WOOD-BASED COMPONENTS

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

2.04 LAMINATE MATERIALS

- A. Manufacturers:
 - 1. As allowed by Hilton Brand Standards for Home 2 Suites Hotels.
- B. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications.

2.05 COUNTERTOPS

- A. Engineered composite counter tops with polished finish and eased edges.
 - 1. Provide components indicated on the drawings.
 - 2. Manufacturer must be selected from Hilton approved vendor list.
 - 3. Colors and textures as required for listed finish packages.

2.06 ACCESSORIES

- A. Adhesive: Type recommended by fabricator to suit application.
- B. Fasteners: Size and type to suit application.
- C. Concealed Joint Fasteners: Threaded steel.
- D. Grommets: Standard plastic grommets for cut-outs, in color to match adjacent surface.

2.07 HARDWARE

- A. Adjustable Shelf Supports: Standard back-mounted system using surface mounted metal shelf standards and coordinated cantilevered shelf brackets, satin chrome finish, for nominal 1 inch (25 mm) spacing adjustments.
- B. Drawer and Door Pulls: "U" shaped wire pull, steel with chrome finish, 4 inch centers ("U" shaped wire pull, steel with chrome finish, 100 mm centers) unless otherwise noted.
- C. Cabinet Locks: Keyed cylinder, two keys per lock, master keyed, steel with chrome finish.
- D. Drawer Slides:
 - 1. Type: Full extension.
 - 2. Static Load Capacity: Commercial grade.
 - 3. Mounting: Side mounted.
 - 4. Stops: Integral type.
 - 5. Features: Provide self closing/stay closed type.
- E. Hinges: European style concealed self-closing type, steel with polished finish.

2.08 SITE FINISHING MATERIALS

- A. Stain and Finishing Materials: As required by AWI/AWMAC/WI (AWS).

2.09 FABRICATION

- A. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.
- B. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.
- C. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.

- D. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet (600 mm) from sink cut-outs.
 - 1. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.
 - 2. Cap exposed plastic laminate finish edges with material of same finish and pattern.
- E. Mechanically fasten back splash to countertops as recommended by laminate manufacturer at 16 inches (400 mm) on center.
- F. Provide cutouts for plumbing fixtures. Verify locations of cutouts from on-site dimensions. Prime paint cut edges.

2.10 SHOP FINISHING

- A. Sand work smooth and set exposed nails and screws.
- B. On items to receive transparent finishes, use wood filler matching or blending with surrounding surfaces and of types recommended for applied finishes.
- C. Finish work in accordance with AWI/AWMAC/WI (AWS), Section 5 - Finishing for grade specified and as follows:
 - 1. Transparent:
 - a. System - 11, Polyurethane, Catalyzed.
 - b. Sheen: Satin.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify adequacy of backing and support framing.
- B. Verify location and sizes of utility rough-in associated with work of this section.

3.02 INSTALLATION

- A. Install work in accordance with AWI/AWMAC/WI (AWS) requirements for grade indicated.
- B. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.
- C. Use fixture attachments in concealed locations for wall mounted components.
- D. Use concealed joint fasteners to align and secure adjoining cabinet units.
- E. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch (0.79 mm). Do not use additional overlay trim for this purpose.
- F. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.

3.03 ADJUSTING

- A. Adjust installed work.
- B. Adjust moving or operating parts to function smoothly and correctly.

3.04 CLEANING

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

END OF SECTION

SECTION 07 1113
BITUMINOUS DAMPPROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Bituminous dampproofing.
- B. Protection boards.

1.02 RELATED REQUIREMENTS

- A. Backfill and compaction per Civil Engineering Drawings.
- B. Section 07 2100 - Thermal Insulation: Rigid insulation board used as protection board.

1.03 REFERENCE STANDARDS

- A. ASTM D41/D41M - Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing; 2011.
- B. ASTM D1227 - Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing; 2013.
- C. ASTM D2822/D2822M - Standard Specification for Asphalt Roof Cement, Asbestos-Containing; 2005 (Reapproved 2011).
- D. ASTM D3747 - Standard Specification for Emulsified Asphalt Adhesive for Adhering Roof Insulation; 1979 (Reapproved 2007).
- E. NRCA ML104 - The NRCA Roofing and Waterproofing Manual; Fifth Edition, with interim updates.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing the work of this section with minimum 3 years experience.

1.06 FIELD CONDITIONS

- A. Maintain ambient temperatures above 40 degrees F (5 degrees C) for 24 hours before and during application until dampproofing has cured.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturers:
 - 1. Karnak Corporation: www.karnakcorp.com.
 - 2. Mar-Flex Systems, Inc: www.mar-flex.com/sle.
 - 3. W.R. Meadows, Inc: www.wrmeadows.com.
 - 4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 DAMPPROOFING PRODUCTS

2.03 COLD ASPHALTIC MATERIALS

- A. Bitumen: Asphalt emulsion, ASTM D3747.
- B. Asphalt Primer: ASTM D41/D41M, compatible with substrate.
- C. Sealing Mastic: Asphalt roof cement, ASTM D2822, Type I.

2.04 ACCESSORIES

- A. Protection Board: Rigid insulation specified in Section 07 2100.

- B. Provide all accessories recommended by manufacturer to provide a complete system.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify substrate surfaces are durable, free of matter detrimental to adhesion or application of dampproofing system.
- C. Verify that items that penetrate surfaces to receive dampproofing are securely installed.

3.02 PREPARATION

- A. Protect adjacent surfaces not designated to receive dampproofing.
- B. Clean and prepare surfaces to receive dampproofing in accordance with manufacturer's instructions.
- C. Do not apply dampproofing to surfaces unacceptable to manufacturer.
- D. Apply mastic to seal penetrations, small cracks, or minor honeycomb in substrate.

3.03 APPLICATION

- A. Prime surfaces in accordance with manufacturer's instructions.
- B. Apply bitumen by spray application.
- C. Apply bitumen at a temperature limited by equiviscous temperature (EVT) plus or minus 25 F (14 C); do not exceed finish blowing temperature for four hours.
- D. Apply bitumen in one coat, continuous and uniform, at a rate of 25 sq ft/gal (0.6 sq m/L) per coat.
- E. Apply from 2 inches (50 mm) below finish grade elevation down to top of footings.
- F. Seal items projecting through dampproofing surface with mastic. Seal watertight.

END OF SECTION

SECTION 07 2100
THERMAL INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Board insulation at cavity wall construction, perimeter foundation wall, and exterior wall behind lap siding and metal siding wall finish.
- B. Batt insulation and vapor retarder in exterior wall, ceiling, and roof construction.
- C. Insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.
- D. Sound batt insulation in interior wall, ceiling and floor construction.

1.02 RELATED REQUIREMENTS

- A. Section 04 2000 - Unit Masonry.
- B. Section 06 1000 - Rough Carpentry: Supporting construction for batt insulation.
- C. Section 07 2400 - Exterior Insulation and Finish Systems: Board insulation on exterior side of walls, finished with weatherproof coating.
- D. Section 07 2500 - Weather Barriers: Separate air barrier and vapor retarder materials.
- E. Section 07 5300 - Elastomeric Membrane Roofing: Insulation specified as part of roofing system.
- F. Section 07 8400 - Firestopping: Insulation as part of fire-rated through-penetration assemblies.
- G. Section 09 2116 - Gypsum Board Assemblies: Acoustic insulation inside walls and partitions.

1.03 REFERENCE STANDARDS

- A. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation; 2015.
- B. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2015a.
- C. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2012.
- D. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2016.
- E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
- F. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2014.
- G. ASTM E136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace At 750 Degrees C; 2016.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.

1.05 FIELD CONDITIONS

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

PART 2 PRODUCTS

2.01 APPLICATIONS

- A. Insulation at Perimeter of Foundation: Expanded polystyrene board.
- B. Insulation Inside Masonry Cavity Walls: Extruded polystyrene board.
- C. Insulation in Wood Framed Walls: Batt insulation with separate vapor retarder.
- D. Continuous insulation over Wood Framed Walls: Rigid foil faced board.
- E. Insulation in Wood Framed Ceiling Structure: Batt insulation with separate vapor retarder.
- F. Insulation Above Ceilings, Interior Wall Cavities: Fiberglass Sound Batt insulation with no vapor retarder.
- G. Insulation Over Roof Deck: Polyisocyanurate board.

2.02 FOAM BOARD INSULATION MATERIALS

- A. Expanded Polystyrene (EPS) Board Insulation: ASTM C578, Type XI; with the following characteristics:
 - 1. Flame Spread Index: 75 or less, when tested in accordance with ASTM E84.
 - 2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
 - 3. Board Size: 48 by 96 inch (1220 by 2440 mm).
 - 4. Board Thickness: 3 inches (75 mm).
 - 5. Board Edges: Square.
 - 6. Water Absorption: 4 percent by volume, maximum.
 - 7. Compressive Resistance: 25 psi (173 kPa).
 - 8. Thermal Resistance: R-value (RSI-value) of 5 (____) per 1 inch (25.4 mm) at 75 degrees F (24 degrees C) mean temperature.
 - 9. Manufacturers:
 - a. AFM Corp: www.r-control.com.
 - b. Diversifoam Products: www.diversifoam.com.
 - c. Substitutions: See Section 01 6000 - Product Requirements.
- B. Extruded Polystyrene Board Insulation: Extruded polystyrene board; ASTM C578; with either natural skin or cut cell surfaces, and the following characteristics:
 - 1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
 - 2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
 - 3. R-value (RSI-value); 1 inch (25 mm) of material at 72 degrees F (22 C): 7 (____), minimum.
 - 4. Board Edges: Square.
 - 5. Water Absorption, Maximum: 0.3 percent, by volume.
 - 6. Manufacturers:
 - a. Dow Chemical Co: www.dow.com.
 - b. Owens Corning Corporation; FOAMULAR Extruded Polystyrene (XPS) Insulation: www.ocbuildingspec.com.
 - c. Kingspan Insulation LLC; GreenGuard XPS TYPE IV 25 PSI: www.trustgreenguard.com.
 - d. Substitutions: See Section 01 6000 - Product Requirements.
- C. Polyisocyanurate Board Insulation with Facers Both Sides: Rigid cellular foam, complying with ASTM C1289; Type I, aluminum foil both faces; Class 1, non-reinforced foam core.
 - 1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
 - 2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
 - 3. Compressive Strength: 16 psi (110 kPa)
 - 4. Board Size: 48 by 96 inch (1220 by 2440 mm) or larger.
 - 5. Thermal Resistance: R-value (RSI-value) of 3.8 (minimum).
 - 6. Board Edges: Square.
 - 7. Manufacturers:

- a. Atlas Roofing Corporation; AC Foam-II Polyiso Roof Insulation: www.atlasroofing.com/sle.
- b. Carlisle Coatings & Waterproofing, Inc; R2+ Matte: www.carlisleccw.com/sle.
- c. Johns Manville; AP Foil-Faced: www.jm.com.
- d. Substitutions: See Section 01 6000 - Product Requirements.

2.03 BATT INSULATION MATERIALS

- A. Glass Fiber Batt Insulation: Flexible preformed batt or blanket, complying with ASTM C665; friction fit.
 - 1. Combustibility: Non-combustible, when tested in accordance with ASTM E136.
 - 2. Thermal Resistance: R-value (RSI-value) of 21 (____) at exterior wood framed walls.
 - 3. Thickness: 5-1/2 inch (____ mm).
 - 4. Facing: Unfaced.
 - 5. Manufacturers:
 - a. CertainTeed Corporation: www.certainteed.com.
 - b. Johns Manville: www.jm.com.
 - c. Owens Corning Corporation; EcoTouch PINK FIBERGLAS Insulation: www.ocbuildingspec.com.
 - 6. Substitutions: See Section 01 6000 - Product Requirements.
- B. Mineral Fiber Batt Insulation: Flexible or semi-rigid preformed batt or blanket, complying with ASTM C665; friction fit; unfaced flame spread index of 0 (zero) when tested in accordance with ASTM E84.
 - 1. Smoke Developed Index: 0 (zero), when tested in accordance with ASTM E84.
 - 2. Thickness: Varies, provide thicknesses as indicated on the drawings.
 - 3. Manufacturers:
 - a. Johns Manville; MinWool Sound Attenuation Fire Batts: www.jm.com.
 - b. Thermafiber, Inc.; SAFB: www.thermafiber.com.
 - c. ROXUL, Inc; ComfortBatt: www.roxul.com.
 - 4. Substitutions: See Section 01 6000 - Product Requirements.

2.04 ACCESSORIES

- A. Sheet Vapor Retarder: Clear polyethylene film for above grade application, 10 mil (0.25 mm) thick.
- B. Tape: Bright aluminum self-adhering type, mesh reinforced, 2 inch (50 mm) wide.
- C. Staples: Steel wire; electroplated or galvanized; type and size to suit application.
- D. Adhesive: Type recommended by insulation manufacturer for application.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.
- B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

3.02 BOARD INSTALLATION AT FOUNDATION PERIMETER

- A. Apply adhesive to back of boards:
 - 1. Three continuous beads per board length.
- B. Install boards horizontally on foundation perimeter.
 - 1. Place boards to maximize adhesive contact.
 - 2. Install in running bond pattern.
 - 3. Butt edges and ends tightly to adjacent boards and to protrusions.
- C. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.03 BOARD INSTALLATION AT EXTERIOR WALLS

- A. Apply manufacturer recommended adhesive to back of boards:
 - 1. Three continuous beads per board length.
- B. Install boards horizontally on walls.
 - 1. Place boards to maximize adhesive contact.
 - 2. Install in running bond pattern.
 - 3. Butt edges and ends tightly to adjacent boards and to protrusions.
- C. Extend boards over expansion joints, unbonded to wall on one side of joint.
- D. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.
- E. Place 6 inch (150 mm) wide polyethylene sheet at perimeter of wall openings, from adhesive vapor retarder bed to window and door frames. Tape seal in place to ensure continuity of vapor retarder and air seal.
- F. Tape insulation board joints.

3.04 BOARD INSTALLATION AT CAVITY WALLS

- A. Install boards to fit snugly between wall ties.
 - 1. Place membrane surface facing out, and tape seal board joints.
- B. Install boards horizontally on walls.
 - 1. Place boards to maximize adhesive contact.
 - 2. Install in running bond pattern.
 - 3. Butt edges and ends tightly to adjacent boards and to protrusions.
 - 4. Place impale fastener locking discs.
- C. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.
- D. Place 6 inch (150 mm) wide polyethylene sheet at perimeter of wall openings, from adhesive vapor retarder bed to window and door frames. Tape seal in place to ensure continuity of vapor retarder and air seal.

3.05 BATT INSTALLATION

- A. Install insulation and vapor retarder in accordance with manufacturer's instructions.
- B. Install in exterior wall and roof spaces without gaps or voids. Do not compress insulation.
- C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.
- D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.
- E. At exterior wood framing, place vapor retarder on warm side of insulation by stapling at 6 inches (150 mm) on center. Lap and seal sheet retarder joints over member face.
- F. Tape seal tears or cuts in vapor retarder.
- G. Extend vapor retarder tightly to full perimeter of adjacent window and door frames and other items interrupting the plane of the membrane. Tape seal in place.

3.06 PROTECTION

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

END OF SECTION

SECTION 07 2400
EXTERIOR INSULATION AND FINISH SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Composite wall cladding of rigid insulation and reinforced finish coating ("Class PB").
- B. Drainage and water-resistive barriers behind insulation board.

1.02 RELATED REQUIREMENTS

- A. Section 06 1000 - Rough Carpentry: Sheathing on wood framing.
- B. Section 07 6200 - Sheet Metal Flashing and Trim: Perimeter flashings.
- C. Section 07 9200 - Joint Sealants: Sealing joints between EIFS and adjacent construction and penetrations through EIFS.

1.03 REFERENCE STANDARDS

- A. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus; 2011.
- B. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2015a.
- C. ASTM C1397 - Standard Practice for Application of Class PB Exterior Insulation and Finish Systems (EIFS) and EIFS with Drainage; 2013.
- D. ASTM D968 - Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive; 2005 (Reapproved 2010).
- E. ASTM D2247 - Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity; 2011.
- F. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2012.
- G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
- H. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2009).
- I. ASTM E2273 - Standard Test Method for Determining the Drainage Efficiency of Exterior Insulation and Finish Systems (EIFS) Clad Wall Assemblies; 2003 (Reapproved 2011).
- J. ASTM G153 - Standard Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials; 2013.
- K. ASTM G155 - Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Nonmetallic Materials; 2013.
- L. ICC-ES AC219 - Acceptance Criteria for Exterior Insulation and Finish Systems; 2009.
- M. NFPA 259 - Standard Test Method for Potential Heat of Building Materials; 2013.
- N. NFPA 268 - Standard Test Method for Determining Ignitibility of Exterior Wall Assemblies Using a Radiant Heat Energy Source; 2012.
- O. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components; 2012.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on system materials, product characteristics, performance criteria, and system limitations.
- C. Shop Drawings: Indicate wall and soffit joint patterns, joint details, and molding profiles.
- D. Selection Samples: Submit manufacturer's standard range of samples illustrating available coating colors and textures.

- E. Verification Samples: Submit actual samples of selected coating on specified substrate, minimum 12 inches (300 mm) square, illustrating project colors and textures.

1.05 QUALITY ASSURANCE

- A. Maintain copy of specified installation standard and manufacturer's installation instructions at project site during installation.
- B. EIFS Manufacturer Qualifications: Provide EIFS products other than insulation from the same manufacturer with qualifications as follows:
 - 1. Member in good standing of EIMA (EIFS Industry Members Association).
 - 2. Manufacturer of EIFS products for not less than 5 years.
 - 3. Manufacturing facilities ISO 9001 certified.
- C. Insulation Manufacturer Qualifications: Approved by manufacturer of EIFS and approved and labeled under third party quality program as required by applicable building code.
- D. Installer Qualifications: Company specializing in the type of work specified and with at least five years of documented experience.

1.06 MOCK-UP

- A. Construct mock-up of typical EIFS application on specified substrate, size as required to include examples of all key conditions, and including flashings, joints, and edge conditions.
- B. Mock-up may remain as part of the Work.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver materials to project site in manufacturer's original, unopened containers with labels intact. Inspect materials and notify manufacturer of any discrepancies.
- B. Storage: Store materials as directed by manufacturer's written instructions.
 - 1. Protect adhesives and finish materials from freezing, temperatures below 40 degrees F (4 degrees C) and temperatures in excess of 90 degrees F (32 degrees C).
 - 2. Protect Portland cement based materials from moisture and humidity. Store under cover off the ground in a dry location.
 - 3. Protect insulation materials from exposure to sunlight.

1.08 FIELD CONDITIONS

- A. Do not prepare materials or apply EIFS under conditions other than those described in the manufacturer's written instructions.
- B. Do not prepare materials or apply EIFS during inclement weather unless areas of installation are protected. Protect installed EIFS areas from inclement weather until dry.
- C. Do not install coatings or sealants when ambient temperature is below 40 degrees F (5 degrees C).
- D. Do not leave installed insulation board exposed to sunlight for extended periods of time.

1.09 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Provide manufacturer's standard material warranty, covering a period of not less than 5 years.
- C. Provide separate warranty from installer covering labor for repairs or replacement for a period of not less than 5 years.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers:
 - 1. Basis of Design: Dryvit Systems, Inc; Dryvit Outsulation Plus MD Exterior Insulation and Finish System, Class PB with Moisture Drainage: www.dryvit.com.

2.02 EXTERIOR INSULATION AND FINISH SYSTEM

- A. Fire Characteristics:

1. Flammability: Pass, when tested in accordance with NFPA 285.
 2. Ignitibility: No sustained flaming when tested in accordance with NFPA 268.
 3. Potential Heat of Foam Plastic Insulation Tested Independently of Assembly: No portion of the assembly having potential heat that exceeds that of the insulation sample tested for flammability (above), when tested in accordance with NFPA 259 with results expressed in Btu per square foot (mJ/sq m).
- B. Water Penetration Resistance: No water penetration beyond the plane of the base coat/insulation board interface after 15 minutes, when tested in accordance with ASTM E331 at 6.24 psf (299 Pa) differential pressure with tracer dye in the water spray; include in tested sample at least two vertical joints and one horizontal joint of same type to be used in construction; disassemble sample if necessary to determine extent of water penetration.
 - C. Drainage Efficiency: Average minimum efficiency of 90 percent, when tested in accordance with ASTM E2273 for 75 minutes.
 - D. Salt Spray Resistance: No cracking, checking, crazing, erosion, blistering, peeling, delamination, or corrosion of finish coating after 300 hours exposure in accordance with ASTM B117, using at least three samples matching intended assembly, at least 4 by 6 inches (100 by 150 mm) in size.
 - E. Freeze-Thaw Resistance: No cracking, checking, crazing, erosion, blistering, peeling, delamination, or corrosion of finish coating when viewed under 5x magnification after 10 cycles, when tested in accordance with ICC-ES AC219 or AC235.
 - F. Weathering Resistance: No cracking, checking, crazing, erosion, blistering, peeling, delamination, or corrosion of finish coating when viewed under 5x magnification after 2000 hours of accelerated weathering conducted in accordance with ASTM G153 Cycle 1 or ASTM G155 Cycle 1, 5, or 9.
 - G. Water Degradation Resistance: No cracking, checking, crazing, erosion, blistering, peeling, delamination, or corrosion of finish coating after 14 days exposure, when tested in accordance with ASTM D2247.
 - H. Mildew Resistance: No growth supported on finish coating during 28 day exposure period, when tested in accordance with ASTM D3273.
 - I. Abrasion Resistance Of Finish: No cracking, checking or loss of film integrity when tested in accordance with ASTM D968 with 500 liters of sand.

2.03 MATERIALS

- A. Finish Coating Top Coat: Water-based, air curing, acrylic or polymer-based finish with integral color and texture.
 1. Texture: Fine pebble at Envelope Wrap - primary color locations.
 2. Texture: Dryvit Systems, Inc., Specialty Finish Options; Finesse at Core Direct finish and Accent Option locations.
 3. Colors: See Exterior Building Elevations for locations..
 - a. Envelope Wrap primary color to match Benjamin Moore 1046 Sandy Brown.
 - b. Core Direct Finish color to match Benjamin Moore 398 Flower Power.
 - c. Accent Option color to match Benjamin Moore 2134-50 Gull Wing Gray.
- B. Base Coat: Fiber-reinforced, acrylic or polymer-based product compatible with insulation board and reinforcing mesh and finish coat.
- C. Insulation Board: Molded expanded polystyrene (EPS) board insulation, ASTM C578, Type XI, with the following characteristics:
 1. Board Thickness: As indicated on drawings.
 2. Thickness Tolerance: Plus/minus 1/16 inch (1.5 mm) maximum.
 3. Board Edges: Square.
 4. Thermal Resistance (R factor per 1 inch (25.4 mm)) at 75 degrees F (24 degrees C): 3.60 (0.63).
 5. Board Density: 0.9 lb/cu ft (15 kg/cu m).

6. Compressive Resistance: 10 psi (69 kPa).
7. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/450, when tested in accordance with ASTM E84.
8. Manufacturers:
 - a. As listed and approved by Dryvit Systems, Inc..

2.04 ACCESSORY MATERIALS

- A. Metal Flashings: As specified in Section 07 6200.
- B. Trim: EIFS manufacturer's standard PVC or galvanized steel trim accessories, as required for a complete project and including starter track and drainage accessories.
- C. Sealant Materials: Compatible with EIFS materials and as recommended by EIFS manufacturer.

PART 3 EXECUTION

3.01 GENERAL

- A. Install in accordance with EIFS manufacturer's instructions and ASTM C1397.
- B. Where different requirements appear in either document, comply with the most stringent.
- C. Neither of these documents supercedes the provisions of the Contract Documents that define the contractual relationships between the parties or the scope of work.

3.02 EXAMINATION

- A. Verify that substrate is sound and free of oil, dirt, other surface contaminants, efflorescence, loose materials, or protrusions that could interfere with EIFS installation and is of a type and construction that is acceptable to EIFS manufacturer. Do not begin work until substrate and adjacent materials are complete and thoroughly dry.
- B. Verify that substrate surface is flat, with no deviation greater than 1/4 in (6 mm) when tested with a 10 ft (3 m) straightedge.

3.03 INSTALLATION - WATER-RESISTIVE BARRIER

- A. Seal substrate transitions and intersections with other materials to form continuous water-resistive barrier on exterior of sheathing, using method recommended by manufacturer.
- B. At door and window rough openings and other wall penetrations, seal water-resistive barrier and flexible flashings to rough opening before installation of metal flashings, sills, or frames, using method recommended by manufacturer.
- C. Lap flexible flashing or flashing tape at least 2 inches (50 mm) on each side of joint or transition.
- D. Install drainage layer or spacers after flashing tape has been completed.

3.04 INSTALLATION - INSULATION

- A. Install in accordance with manufacturer's instructions.
- B. Install back wrap reinforcing mesh at all openings and terminations that are not to be protected with trim.
- C. On wall surfaces, install boards horizontally. On horizontal surfaces, install boards _____.
- D. Place boards in a method to maximize tight joints. Stagger vertical joints and interlock at corners. Butt edges and ends tight to adjacent board and to protrusions. Achieve a continuous flush insulation surface, with no gaps in excess of 1/16 inch (1.6 mm).
- E. Fill gaps greater than 1/16 inch (1.6 mm) with strips or shims cut from the same insulation material.
- F. Rasp irregularities off surface of installed insulation board.

3.05 INSTALLATION - CLASS PB FINISH

- A. Base Coat: Apply in thickness as necessary to fully embed reinforcing mesh, wrinkle free, including back-wrap at terminations of EIFS. Install reinforcing fabric as recommended by EIFS manufacturer.

1. Lap reinforcing mesh edges and ends a minimum of 2-1/2 inches (64 mm).
 2. Allow base coat to dry a minimum of 24 hours before next coating application.
- B. Install expansion joints at floor lines as recommended by EIFS manufacturer and as indicated on the drawings.
- C. Apply finish coat after base coat has dried not less than 24 hours, embed finish aggregate, and finish to a uniform texture and color.
- D. Finish Coat Thickness: As recommended by manufacturer.
- E. Seal control and expansion joints within the field of exterior finish and insulation system, using procedures recommended by sealant and finish system manufacturers.

3.06 CLEANING

- A. Clean EIFS surfaces and work areas of foreign materials resulting from EIFS operations.

3.07 PROTECTION

- A. Protect completed work from damage and soiling by subsequent work.

END OF SECTION

SECTION 07 2500
WEATHER BARRIERS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Water-Resistive Barrier: Under exterior wall cladding, over sheathing or other substrate; not air tight or vapor retardant.
- B. Air Barriers: Materials that form a system to stop passage of air through exterior walls, joints between exterior walls and roof, and joints around frames of openings in exterior walls.

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete: Vapor retarder under concrete slabs on grade.
- B. Section 06 1000 - Rough Carpentry: Water-resistive barrier under exterior cladding.
- C. Section 07 2100 - Thermal Insulation: Continuous exterior insulation.
- D. Section 07 2400 - Exterior Insulation and Finish Systems: Water-resistive barrier under exterior insulation.
- E. Section 07 5300 - Elastomeric Membrane Roofing: Vapor retarder installed as part of roofing system.
- F. Section 07 6200 - Sheet Metal Flashing and Trim: Metal flashings installed in conjunction with weather barriers.

1.03 REFERENCE STANDARDS

- A. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2015a.
- B. ASTM D4397 - Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications; 2010.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
- D. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2014.
- E. ASTM E2178 - Standard Test Method for Air Permeance of Building Materials; 2013.
- F. ICC-ES AC38 - Acceptance Criteria for Water-Resistive Barriers; ICC Evaluation Service, Inc.; 2013.

1.04 FIELD CONDITIONS

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

PART 2 PRODUCTS

2.01 WEATHER BARRIER ASSEMBLIES

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

- A. Air Barrier Sheet, Mechanically Fastened:
 - 1. Air Permeance: 0.004 cubic feet per minute per square foot (0.02 L/s/sq m), maximum, when tested in accordance with ASTM E2178.
 - 2. Water Vapor Permeance: 5 perms (286 ng/(Pa s sq m)), minimum, when tested in accordance with ASTM E96/E96M Procedure A (desiccant procedure).
 - 3. Ultraviolet and Weathering Resistance: Approved in writing by manufacturer for minimum of 6 months weather exposure.
 - 4. Surface Burning Characteristics: Flame spread index of 25 or less, and smoke developed index of 50 or less, when tested in accordance with ASTM E84.
 - 5. Water Resistance: Comply with applicable water-resistive requirements of ICC-ES Acceptance Criteria AC38.

6. Seam and Perimeter Tape: Polyethylene self adhering type, mesh reinforced, 2 inches (50 mm) wide, compatible with sheet material; unless otherwise specified.
7. Install in all exterior wall locations where no continuous exterior insulation or EIFS system is provided.
8. Products:
 - a. DuPont Building Innovations; Tyvek Commercial Wrap with Tyvek Wrap Caps and Tyvek Tape: www.dupont.com.
 - b. Substitutions: See Section 01 6000 - Product Requirements.

2.03 ACCESSORIES

- A. Sealants, Tapes, and Accessories for Sealing Weather Barrier and Sealing Weather Barrier to Adjacent Substrates: As specified or as recommended by weather barrier manufacturer.
- B. Flexible Flashing: Self-adhesive sheet flashing complying with ASTM D1970/D1970M, except slip resistance requirement is waived if not installed on a roof.
- C. Thinners and Cleaners: As recommended by material manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

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

3.02 PREPARATION

- A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.
- B. Clean and prime substrate surfaces to receive adhesives in accordance with manufacturer's instructions.

3.03 INSTALLATION

- A. Install materials in accordance with manufacturer's instructions.
- B. Air Barriers: Install continuous air barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.
- C. Mechanically Fastened Sheets - On Exterior:
 1. Install sheets shingle-fashion to shed water, with seams generally horizontal.
 2. Overlap seams as recommended by manufacturer but at least 6 inches.
 3. Overlap at outside and inside corners as recommended by manufacturer but at least 12 inches (305 mm).
 4. For applications specified to be air tight, seal seams, laps, penetrations, tears, and cuts with self-adhesive tape; use only large-headed, gasketed fasteners recommended by the manufacturer.
 5. Install air barrier and vapor retarder UNDER jamb flashings.
 6. Install head flashings under weather barrier.
 7. At openings to be filled with frames having nailing flanges, wrap excess sheet into opening; at head, seal sheet over flange and flashing.
- D. Openings and Penetrations in Exterior Weather Barriers:
 1. Install flashing over sills, covering entire sill frame member, extending at least 5 inches (125 mm) onto weather barrier and at least 6 inches (150 mm) up jambs; mechanically fasten stretched edges.
 2. At openings to be filled with frames having nailing flanges, seal head and jamb flanges using a continuous bead of sealant compressed by flange and cover flanges with at least 4 inches (100 mm) wide; do not seal sill flange.
 3. At openings to be filled with non-flanged frames, seal weather barrier to all sides of opening framing, using flashing at least 9 inches (230 mm) wide, covering entire depth of framing.
 4. At head of openings, install flashing under weather barrier extending at least 2 inches (50 mm) beyond face of jambs; seal weather barrier to flashing.

5. At interior face of openings, seal gap between window/door frame and rough framing, using joint sealant over backer rod.
6. Service and Other Penetrations: Form flashing around penetrating item and seal to weather barrier surface.

3.04 FIELD QUALITY CONTROL

- A. Do not cover installed weather barriers until required inspections have been completed.

3.05 PROTECTION

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

END OF SECTION

SECTION 07 4213
METAL WALL PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Manufactured metal panels for walls, with related flashings and accessory components.

1.02 RELATED REQUIREMENTS

- A. Section 06 1000 - Rough Carpentry: Wall panel substrate.
- B. Section 07 2100 - Thermal Insulation.
- C. Section 07 2500 - Weather Barriers: Weather barrier under wall panels.

1.03 REFERENCE STANDARDS

- A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.
- B. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process; 2010 (Reapproved 2015).

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate dimensions, layout, joints, construction details, methods of anchorage.
- C. Samples: Submit two samples of wall panel, 4 inch (____ mm) by 4 inch (____ mm) in size illustrating finish color, sheen, and texture.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years of documented experience.
- B. Installer Qualifications: Company specializing in installing the products specified in this section with minimum three years of documented experience.

1.06 MOCK-UP

- A. Construct mock-up, 6 feet (____ m) long by 6 feet (____ m) wide; include panel system, attachments to building frame, associated vapor retarder and air seal materials, weep drainage system, sealants and seals, related insulation in mock-up.
- B. Mock-up may remain as part of the Work.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Store prefinished material off ground and protected from weather. Prevent twisting, bending, or abrasion, and provide ventilation to stored materials. Slope metal sheets to ensure drainage.
- B. Prevent contact with materials that may cause discoloration or staining of products.

1.08 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective work within a ten year period after the Date of Substantial Completion for degradation of panel finish, including color fading caused by exposure to weather.
- C. Correct defective Work within a five year period after the Date of Substantial Completion, including defects in water tightness and integrity of seals.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Design is based on 7.2" Structural Panel manufactured by Bridger Steel.
- B. Other Acceptable Manufacturers:
 - 1. Berridge Manufacturing Company: www.berridge.com/sle.
 - 2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MANUFACTURED METAL PANELS

- A. Wall Panel System: Factory fabricated prefinished metal panel system, site assembled.
 - 1. Provide exterior panels.
 - 2. Design and size components to withstand dead and live loads caused by positive and negative wind pressure acting normal to plane of wall.
 - 3. Design Pressure: In accordance with applicable codes.
 - 4. Maximum Allowable Deflection of Panel: 1/90 of span.
 - 5. Movement: Accommodate movement within system without damage to components or deterioration of seals, movement within system; movement between system and perimeter components when subject to seasonal temperature cycling; dynamic loading and release of loads; and deflection of structural support framing.
 - 6. Drainage: Provide positive drainage to exterior for moisture entering or condensation occurring within panel system.
 - 7. Fabrication: Formed true to shape, accurate in size, square, and free from distortion or defects; pieces of longest practical lengths.
 - 8. Corners: Factory-fabricated in one continuous piece with minimum 4 inch (____ mm) returns.
 - 9. Provide continuity of air barrier and vapor retarder seal at building enclosure elements in conjunction with materials specified in Section 07 2500.
 - 10. Panel Finishes:
 - 11. Exterior Finish: Panel manufacturer's standard polyvinylidene fluoride (PVDF) coating, top coat over epoxy primer.
 - 12. Exterior Panel Back Coating: Panel manufacturer's standard siliconized polyester wash coat.
- B. Exterior Panels:
 - 1. Profile: Vertical; box rib style.
 - 2. Side Seams: Anti-Siphon groove, tight fitting, sealed with continuous bead of sealant.
 - 3. Material: Precoated steel sheet, 24 gage, ____ inch (____ mm) minimum thickness.
 - 4. Panel Width: 36 inches (____ mm) coverage.
 - 5. Color: Closest match to Benjamin Moore 2134-20 Midsummer Night.
- C. Internal and External Corners: Same material, thickness, and finish as exterior sheets; profile to suit system; brake formed to required angles.
- D. Expansion Joints: Same material, thickness and finish as exterior sheets; 24 gage, ____ inch (____ mm) thick; manufacturer's standard brake formed type, of profile to suit system.
- E. Trim: Same material, thickness and finish as exterior sheets; brake formed to required profiles.
- F. Anchors: Galvanized steel with neoprene washers, color to match siding.

2.03 MATERIALS

- A. Precoated Steel Sheet: Hot-dipped galvanized steel sheet, ASTM A653/A653M Structural Steel (SS) or Forming Steel (FS), with G90/Z275 coating; continuous coil-coated on exposed surfaces with specified finish coating and on panel back with specified panel back coating.

2.04 ACCESSORIES

- A. Sealants:
 - 1. Exposed Sealant: Elastomeric; silicone, polyurethane, or silyl-terminated polyether/polyurethane.
 - 2. Concealed Sealant: Non-curing butyl sealant or tape sealant.
- B. Fasteners: Manufacturer's standard type to suit application; with soft neoprene washers, steel, hot dip galvanized. Fastener cap same color as exterior panel.
- C. Field Touch-up Paint: As recommended by panel manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that building framing members are ready to receive panels.
- B. Verify that weather barrier has been installed over substrate completely and correctly.

3.02 INSTALLATION

- A. Install panels on walls in accordance with manufacturer's instructions.
- B. Protect surfaces in contact with cementitious materials and dissimilar metals with bituminous paint. Allow to dry prior to installation.
- C. Fasten panels to structural supports; aligned, level, and plumb.
- D. Provide expansion and construction joints where indicated on drawings.
- E. Seal and place gaskets to prevent weather penetration. Maintain neat appearance.

3.03 TOLERANCES

- A. Maximum Offset From True Alignment Between Adjacent Members Butting or In Line: 1/16 inch (1.6 mm).

3.04 CLEANING

- A. Remove site cuttings from finish surfaces.
- B. Clean and wash prefinished surfaces with mild soap and water; rinse with clean water.

END OF SECTION

SECTION 07 4646
FIBER CEMENT SIDING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wood-fiber cement siding; Lap siding and Panel siding.
- B. Wood-fiber cement soffit panels.

1.02 RELATED REQUIREMENTS

- A. Section 06 1000 - Rough Carpentry: Siding substrate.
- B. Section 07 2500 - Weather Barriers: Weather barrier under siding.
- C. Section 07 9200 - Joint Sealants: Sealing joints between siding and adjacent construction and fixtures.
- D. Section 09 9113 - Exterior Painting: Field painting.

1.03 REFERENCE STANDARDS

- A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.
- B. ASTM C1186 - Standard Specification for Flat Fiber Cement Sheets; 2008 (Reapproved 2012).

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Manufacturer's requirements for related materials to be installed by others.
 - 2. Preparation instructions and recommendations.
 - 3. Storage and handling requirements and recommendations.
 - 4. Installation methods, including nail patterns.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing work of the type specified in this section with minimum 3 years of experience.

PART 2 PRODUCTS

2.01 SIDING

- A. Lap Siding: Individual horizontal boards made of cement and cellulose fiber formed under high pressure with integral surface texture, complying with ASTM C1186 Type A Grade II; with machined edges, for nail attachment.
 - 1. Style: Standard lap style.
 - 2. Texture: Smooth.
 - 3. Length: 12 ft (3.7 m), nominal.
 - 4. Width (Height): 6 inches (152 mm).
 - 5. Thickness: 5/16 inch (8 mm), nominal.
 - 6. Finish: Factory applied primer.
 - 7. Color: Benjamin Moore 2164-20 Marsh Brown.
 - 8. Warranty: 30 year limited; transferable.
 - 9. Lap Siding Manufacturers:
 - a. James Hardie Building Products, Inc: www.jameshardie.com.
 - b. Substitutions: See Section 01 6000 - Product Requirements.
- B. Panel Siding: Vertically oriented panels made of cement and cellulose fiber formed under high pressure with integral surface texture, complying with ASTM C1186 Type A Grade II; with machined edges, for nail attachment.
 - 1. Texture: Smooth.
 - 2. Length (Height): 96 inches (2400 mm), nominal.

3. Width: 48 inches (1220 mm).
4. Thickness: 5/16 inch (8 mm), nominal.
5. Finish: Factory applied primer.
6. Color: Benjamin Moore OC-17 White Dove.
7. Warranty: 30 year limited; transferable.
8. Panel Siding Manufacturers:
 - a. James Hardie Building Products, Inc: www.jameshardie.com.

C. Soffit Panels: Smooth panels of same material and finish as panel siding.

2.02 ACCESSORIES

- A. Trim: Metal reveal flashing, drip flashing and trim as indicated on drawings. Paint to match siding / soffit panels..
- B. Fasteners: Galvanized or corrosion resistant; length as required to penetrate minimum 1-1/4 inch (32 mm).
- C. Sealant: Elastomeric, polyurethane or silyl-terminated polyether/polyurethane, and capable of being painted.

PART 3 EXECUTION

3.01 PREPARATION

- A. Examine substrate and clean and repair as required to eliminate conditions that would be detrimental to proper installation.
- B. Verify that weather barrier has been installed over substrate completely and correctly.
- C. Do not begin until unacceptable conditions have been corrected.
- D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

- A. Install sheet metal flashing:
 1. Above door and window trim and casings.
 2. Above horizontal trim in field of siding.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions and recommendations.
 1. Read warranty and comply with all terms necessary to maintain warranty coverage.
 2. Use trim details indicated on drawings.
 3. Touch up all field cut edges before installing.
 4. Pre-drill nail holes if necessary to prevent breakage.
- B. Joints in Horizontal Siding: Avoid joints in lap siding except at corners; where joints are inevitable stagger joints between successive courses.
- C. Joints in Vertical Siding: Install Z-flashing in horizontal joints between successive courses of vertical siding.
- D. Do not install siding less than 6 inches (150 mm) from surface of ground nor closer than 1 inch (25 mm) to roofs, patios, porches, and other surfaces where water may collect.
- E. After installation, seal all joints except lap joints of lap siding. Seal around all penetrations. Paint all exposed cut edges.
- F. Finish Painting: Specified in Section 09 9113.

3.04 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 07 5300
ELASTOMERIC MEMBRANE ROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Elastomeric roofing membrane, mechanically fastened conventional and adhered conventional application.
- B. Insulation, flat and tapered.
- C. Vapor retarder.
- D. Deck sheathing.
- E. Roof cover boards.
- F. Flashings.
- G. Roofing cant strips, stack boots, and walkway pads.

1.02 RELATED REQUIREMENTS

- A. Section 06 1000 - Rough Carpentry: Wood nailers and curbs.
- B. Section 07 6200 - Sheet Metal Flashing and Trim: Counterflashings.
- C. Section 07 7200 - Roof Accessories: Roof-mounted units; prefabricated curbs.
- D. Section 22 1006 - Plumbing Piping Specialties: Roof drains.

1.03 REFERENCE STANDARDS

- A. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2015a.
- B. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2013.
- C. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2016.
- D. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension; 2006a (Reapproved 2013).
- E. ASTM D624 - Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers; 2000 (Reapproved 2012).
- F. ASTM D746 - Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact; 2014.
- G. ASTM D4637/D4637M - Standard Specification for EPDM Sheet Used in Single-Ply Roof Membrane; 2013.
- H. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2014.
- I. FM DS 1-28 - Wind Design; Factory Mutual Research Corporation; 2007.
- J. NRCA ML104 - The NRCA Roofing and Waterproofing Manual; National Roofing Contractors Association; Fifth Edition, with interim updates.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data indicating membrane materials, flashing materials, insulation, vapor retarder, surfacing, and fasteners.
- C. Shop Drawings: Indicate joint or termination detail conditions, conditions of interface with other materials, and setting plan for tapered insulation.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- E. Manufacturer's Installation Instructions: Indicate membrane seaming precautions and perimeter conditions requiring special attention.

- F. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Perform work in accordance with NRCA Roofing and Waterproofing Manual and manufacturer's instructions.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum 10 years of documented experience.
- C. Installer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience, and approved by manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products in manufacturer's original containers, dry, undamaged, with seals and labels intact.
- B. Store products in weather protected environment, clear of ground and moisture.
- C. Protect foam insulation from direct exposure to sunlight.

1.07 FIELD CONDITIONS

- A. Do not apply roofing membrane during unsuitable weather.
- B. Do not apply roofing membrane when ambient temperature is below 40 degrees F (5 degrees C) or above 90 degrees F (____ degrees C).
- C. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.
- D. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.

1.08 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a two year period after Date of Substantial Completion.
- C. Provide 15 year manufacturer's material and labor warranty to cover failure to prevent penetration of water.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. EPDM Membrane Materials:
 - 1. Carlisle Roofing Systems, Inc: www.carlisle-syntec.com.
 - 2. Firestone Building Products, LLC; ____: www.firestonebpco.com.
 - 3. GenFlex Roofing Systems, LLC; ____: www.genflex.com.
 - 4. Versico, a division of Carlisle Construction Materials Inc; VersiGard EPDM: www.versico.com.
 - 5. Substitutions: See Section 01 6000 - Product Requirements.
- B. Insulation:
 - 1. Dow Chemical Company; ____: www.dow.com.
 - 2. GAF: www.gaf.com/sle.
 - 3. Owens Corning Corporation; ____: www.owenscorning.com.
 - 4. Versico, a division of Carlisle Construction Materials Inc: www.versico.com.
 - 5. Substitutions: See Section 01 6000 - Product Requirements.
- C. Fiberglass-Mat Faced Gypsum Roof Board:
 - 1. DensDeck Prime, Georgia Pacific Gypsum.
 - 2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ROOFING - UNBALLASTED APPLICATIONS

- A. Elastomeric Membrane Roofing: One ply membrane, fully adhered over fiberglass-mat faced gypsum roof board, over vapor retarder and insulation.
- B. Acceptable Insulation Types - Constant Thickness Application: Any type that meets requirements and is approved by membrane manufacturer for application.
 - 1. Minimum 2 layers of polyisocyanurate board.
- C. Acceptable Insulation Types - Tapered Application: Any type that meets requirements and is approved by membrane manufacturer for application.
 - 1. Tapered polyisocyanurate, perlite, or extruded polystyrene board.
- D. All insulation Types to be covered with 1/2" Fiberglass-Mat Faced Gypsum Roof Board and tape all joints with tuk-tape or equal to prevent roofing adhesion from damaging insulation and to provide Hail Damage warranty up to 1-1/2" hail.
- E. Surfacing: Top layer of membrane color; white.

2.03 ROOFING MEMBRANE AND ASSOCIATED MATERIALS

- A. Membrane: Ethylene-propylene-diene-terpolymer (EPDM); externally reinforced with fabric; complying with minimum properties of ASTM D4637.
 - 1. Thickness: 0.045 inch (1.1 mm).
 - 2. Sheet Width: 120 inch (____ mm), minimum; factory-fabricate into largest sheets possible.
 - 3. Color: White.
 - 4. Tensile Strength: 1305 psi (____ MPa), measured in accordance with ASTM D412.
 - 5. Ultimate Elongation: 300 percent, measured in accordance with ASTM D412.
 - 6. Tear Strength: 150 lbf/in (26.3 kN/m), measured in accordance with ASTM D624.
 - 7. Water Vapor Permeability: 2.0 perm inch (____ ng/(Pa s m)), measured in accordance with ASTM E96/E96M.
 - 8. Brittleness Temperature: -49 degrees F (____ degrees C), measured in accordance with ASTM D746.
- B. Seaming Materials: As recommended by membrane manufacturer.
- C. Colored Finish Coating: Neoprene/hypalon, with aluminum powder concentrate; finish coat of white color.
- D. Vapor Retarder: As recommended by roof membrane manufacturer, complying with requirements of fire rating classification; compatible with roofing and insulation materials.
 - 1. Fire-retardant adhesive.
- E. Flexible Flashing Material: Same material as membrane; conforming to the following:
 - 1. Tensile Strength: 1,200 psi (8.3 MPa).
 - 2. Elasticity: 50 percent with full recovery without set.
 - 3. Color: White.

2.04 DECK SHEATHING AND COVER BOARDS

- A. Deck Sheathing: Glass mat faced gypsum panels, ASTM C1177/C1177M, fire resistant type, 1/2 inch (13 mm) thick.
 - 1. Products:
 - a. DensDeck Prime Board.
 - b. Substitutions: See Section 01 6000 - Product Requirements.

2.05 INSULATION

- A. Polyisocyanurate Board Insulation: Rigid cellular foam, complying with ASTM C1289, Type I, aluminum foil both faces; Class 1, non-reinforced foam core and with the following characteristics:
 - 1. Compressive Strength: 16 psi (110 kPa)
 - 2. Board Size: 48 by 96 inch (1220 by 2440 mm).
 - 3. Thermal Resistance: R-value (RSI-value) of 30 (minimum).

- B. Extruded Polystyrene (XPS) Board Insulation: ASTM C578, Type XII; extruded expanded polystyrene board with natural skin surfaces; with the following characteristics:
 - 1. Board Size: 48 by 96 inch (1220 by 2440 mm).
 - 2. Tapered Board: Slope as indicated; minimum thickness 1/2 in (13 mm); fabricate of fewest layers possible.
 - 3. Compressive Resistance: 15 psi (104 kPa).
 - 4. Board Density: 1.20 lb/cu ft (19 kg/cu m).
 - 5. Water Absorption: 0.3 percent by volume, maximum.

2.06 ACCESSORIES

- A. Stack Boots: Prefabricated flexible boot and collar for pipe stacks through membrane; same material as membrane.
- B. Cant Strips: Wood; pressure preservative treated.
- C. Sheathing Adhesive: Non-combustible type, for adhering gypsum sheathing to board insulation.
- D. Sheathing Joint Tape: Manufacturer recommended type, 4 inch (____ mm) wide, self adhering.
- E. Insulation Joint Tape: Glass fiber reinforced type as recommended by insulation manufacturer, compatible with roofing materials; 6 inches (150 mm) wide; self adhering.
- F. Insulation Fasteners: Appropriate for purpose intended.
- G. Membrane Adhesive: As recommended by membrane manufacturer.
- H. Surface Conditioner for Adhesives: Compatible with membrane and adhesives.
- I. Thinners and Cleaners: As recommended by adhesive manufacturer, compatible with membrane.
- J. Insulation Adhesive: As recommended by insulation manufacturer.
- K. Sealants: As recommended by membrane manufacturer.
- L. Walkway Pads: Suitable for maintenance traffic, contrasting color or otherwise visually distinctive from roof membrane.
 - 1. Composition: Roofing membrane manufacturer's standard.
 - 2. Size: 24 by 60 inch (____by____ mm).
 - 3. Surface Color: Tan or yellow.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces and site conditions are ready to receive work.
- B. Verify deck is supported and secure.
- C. Verify deck is clean and smooth, flat, free of depressions, waves, or projections, properly sloped and suitable for installation of roof system.
- D. Verify deck surfaces are dry and free of snow or ice.
- E. Verify that roof openings, curbs, and penetrations through roof are solidly set, and cant strips are in place.

3.02 WOOD DECK PREPARATION

- A. Verify flatness and tightness of joints of wood decking. Fill knot holes with latex filler.
- B. Confirm dry deck by moisture meter with 12 percent moisture maximum.

3.03 VAPOR RETARDER AND INSULATION - UNDER MEMBRANE

- A. Apply vapor retarder to deck surface with adhesive in accordance with manufacturer's instructions.
 - 1. Extend vapor retarder under cant strips and blocking to deck edge.
 - 2. Install flexible flashing from vapor retarder to air seal material of wall construction, lap and seal to provide continuity of the air barrier plane.

- B. Ensure vapor retarder is clean and dry, continuous, and ready for application of insulation.
- C. Lay subsequent layers of insulation with joints staggered minimum 6 inch (150 mm) from joints of preceding layer.
- D. Place tapered insulation to the required slope pattern in accordance with manufacturer's instructions.
- E. Lay boards with edges in moderate contact without forcing. Cut insulation to fit neatly to perimeter blocking and around penetrations through roof.
- F. Tape joints of insulation in accordance with roofing and insulation manufacturers' instructions.
- G. At roof drains, use factory-tapered boards to slope down to roof drains over a distance of 18 inches (450 mm).
- H. Do not apply more insulation than can be covered with membrane in same day.

3.04 MEMBRANE APPLICATION

- A. Roll out membrane, free from wrinkles or tears. Place sheet into place without stretching.
- B. Shingle joints on sloped substrate in direction of drainage.
- C. Fully Adhered Application: Apply adhesive to substrate at rate of Manufacturer recommended gal/square (____ L/sq m). Fully embed membrane in adhesive except in areas directly over or within 3 inches (75 mm) of expansion joints. Fully adhere one roll before proceeding to adjacent rolls.
- D. Overlap edges and ends and seal seams by contact adhesive, minimum 3 inches (75 mm). Seal permanently waterproof. Apply uniform bead of sealant to joint edge.
- E. At intersections with vertical surfaces:
 - 1. Extend membrane over cant strips and up a minimum of 4 inches (100 mm) onto vertical surfaces.
 - 2. Fully adhere flexible flashing over membrane and up to nailing strips.
- F. Around roof penetrations, seal flanges and flashings with flexible flashing.
- G. Coordinate installation of roof drains and related flashings.

3.05 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for general requirements for field quality control and inspection.
- B. Require site attendance of roofing and insulation material manufacturers as required by manufacturers to maintain quality and warranty during installation of the Work.

3.06 CLEANING

- A. Remove bituminous markings from finished surfaces.
- B. In areas where finished surfaces are soiled by work of this section, consult manufacturer of surfaces for cleaning advice and conform to their documented instructions.
- C. Repair or replace defaced or damaged finishes caused by work of this section.

3.07 PROTECTION

- A. Protect installed roofing and flashings from construction operations.
- B. Where traffic must continue over finished roof membrane, protect surfaces using durable materials.

END OF SECTION

SECTION 07 6200
SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fabricated sheet metal items, including flashings, counterflashings, gutters, and downspouts.
- B. Sealants for joints within sheet metal fabrications.
- C. Precast concrete splash pads.

1.02 RELATED REQUIREMENTS

- A. Section 06 1000 - Rough Carpentry: Wood nailers for sheet metal work.
- B. Section 07 7200 - Roof Accessories: Manufactured metal roof curbs.
- C. Section 07 9200 - Joint Sealants: Sealing non-lap joints between sheet metal fabrications and adjacent construction.

1.03 REFERENCE STANDARDS

- A. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2015.
- B. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels; 2013.
- C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.
- D. ASTM B32 - Standard Specification for Solder Metal; 2008 (Reapproved 2014).
- E. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014.
- F. ASTM D226/D226M - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing; 2009.
- G. ASTM D4479/D4479M - Standard Specification for Asphalt Roof Coatings - Asbestos-Free; 2007 (Reapproved 2012)e1.
- H. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2012)e1.
- I. SMACNA (ASMM) - Architectural Sheet Metal Manual; Sheet Metal and Air Conditioning Contractors' National Association; 2012.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.
- C. Samples: Submit two samples 2 x 2 inch (_____ mm) in size illustrating metal finish color.

1.05 QUALITY ASSURANCE

- A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- B. Prevent contact with materials that could cause discoloration or staining.

PART 2 PRODUCTS

2.01 SHEET MATERIALS

- A. Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24 gage (0.0239 inch) (0.61 mm) thick base metal.
- B. Pre-Finished Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24 gage (0.0239) inch (0.61 mm) thick base metal, shop pre-coated with PVDF coating.
 - 1. PVDF (Polyvinylidene Fluoride) Coating: Superior Performance Organic Finish, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system.
 - 2. Color: As selected by Architect from manufacturer's standard colors.

2.02 ACCESSORIES

- A. Fasteners: Galvanized steel, with soft neoprene washers.
- B. Underlayment: ASTM D226/D226M, organic roofing felt, Type I ("No. 15").
- C. Slip Sheet: Rosin sized building paper.
- D. Primer: Galvanized iron type.
- E. Protective Backing Paint: Asphaltic mastic, ASTM D4479 Type I.
- F. Sealant to be Concealed in Completed Work: Non-curing butyl sealant.
- G. Sealant to be Exposed in Completed Work: ASTM C920; elastomeric sealant, 100 percent silicone with minimum movement capability of plus/minus 25 percent and recommended by manufacturer for substrates to be sealed; clear.
- H. Plastic Cement: ASTM D4586, Type I.

2.03 FABRICATION

- A. Form sections true to shape, accurate in size, square, and free from distortion or defects.
- B. Fabricate cleats of galvanized type sheet metal, minimum wide as recommended by SMACNA inches (____ mm) wide, interlocking with sheet.
- C. Form pieces in longest possible lengths.
- D. Hem exposed edges on underside 1/2 inch (13 mm); miter and seam corners.
- E. Form material with flat lock seams, except where otherwise indicated. At moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.
- F. Fabricate corners from one piece with minimum 18 inch (450 mm) long legs; seam for rigidity, seal with sealant.
- G. Fabricate vertical faces with bottom edge formed outward 1/4 inch (6 mm) and hemmed to form drip.
- H. Fabricate flashings to allow toe to extend 2 inches (50 mm) over roofing gravel. Return and brake edges.

2.04 GUTTER AND DOWNSPOUT FABRICATION

- A. Gutters: SMACNA (ASMM), Rectangular profile.
- B. Downspouts: Rectangular profile.
- C. Gutters and Downspouts: Size indicated.
- D. Accessories: Profiled to suit gutters and downspouts.
 - 1. Anchorage Devices: In accordance with SMACNA requirements.
 - 2. Gutter Supports: Brackets.
 - 3. Downspout Supports: Brackets.
- E. Splash Pads: Precast concrete type, of size and profiles indicated; minimum 3000 psi (21 MPa) at 28 days, with minimum 5 percent air entrainment.
- F. Downspout Boots: Galvanized Steel.

- G. Downspout Extenders: Same material and finish as downspouts.
- H. Seal metal joints.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.
- B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.02 PREPARATION

- A. Install starter and edge strips, and cleats before starting installation.
- B. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil (0.4 mm).

3.03 INSTALLATION

- A. Conform to drawing details and per manufacturer's written instructions.
- B. Secure flashings in place using concealed fasteners. Use exposed fasteners only where permitted.
- C. Apply plastic cement compound between metal flashings and felt flashings.
- D. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.
- E. Seal metal joints watertight.
- F. Secure gutters and downspouts in place using concealed fasteners.
- G. Slope gutters 1/4 inch per 10 feet (2.1 mm per m), minimum.
- H. Connect downspouts to downspout boots. Seal connection watertight.
- I. Set splash pads under downspouts.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for field inspection requirements.
- B. Inspection will involve surveillance of work during installation to ascertain compliance with specified requirements.

END OF SECTION

SECTION 07 7200
ROOF ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Roof hatches.

1.02 RELATED REQUIREMENTS

- A. Section 07 6200 - Sheet Metal Flashing and Trim: Roof accessory items fabricated from sheet metal.

1.03 REFERENCE STANDARDS

- A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.
- B. FM (AG) - FM Approval Guide; Factory Mutual Research Corporation; current edition.
- C. UL (DIR) - Online Certifications Directory; Underwriters Laboratories Inc.; current listings at database.ul.com.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used.
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
 - 4. Maintenance requirements.
- C. Shop Drawings: Submit detailed layout developed for this project. Show dimensioned location and number for each type of roof accessory.
- D. Warranty Documentation:
 - 1. Submit manufacturer warranty.
 - 2. Ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store products under cover and elevated above grade.

1.06 WARRANTY

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

PART 2 PRODUCTS

2.01 ROOF HATCHES

- A. Manufacturers - Roof Hatches:
 - 1. Acudor Products Inc; Galvanized Steel Roof Hatch: www.acudor.com.
 - 2. Babcock-Davis; Personnel II (Ladder Access): www.babcockdavis.com.
 - 3. Bilco Company; Type TB (all types & special size): www.bilco.com.
 - 4. Dur-Red Products; _____: www.dur-red.com.
 - 5. Milcor, Inc; _____: www.milcorinc.com.
 - 6. Williams Brothers Corporation of America; _____: www.wbdoors.com.
 - 7. Substitutions: See Section 01 6000 - Product Requirements.
- B. Roof Hatches and Smoke Vents, General: Factory-assembled steel frame and cover, complete with operating and release hardware.
 - 1. Style: Provide flat metal covers unless otherwise indicated.
 - 2. Mounting: Provide frames and curbs suitable for mounting conditions indicated on the drawings.

3. Thermally Broken Hatches: Added insulation to frame and cover; available in all standard BILCO single leaf sizes; special sizes available upon request
 4. Size(s): As indicated on drawings; single-leaf style unless indicated as double-leaf.
 5. For Ships Ladder Access: Single leaf; 48 by 48 inches (1220 by 1220 mm) to meet IBC roof access requirements.
- C. Frames/Curbs: One-piece curb and frame with integral cap flashing to receive roof flashings; extended bottom flange to suit mounting.
1. Material: Galvanized steel, 14 gage, 0.0747 inch (1.90 mm) thick.
 2. Finish: Factory prime paint and powder coat paint.
 3. Insulation: Manufacturer's standard; 2 inches (50 mm) rigid glass fiber, located on outside face of curb.
 4. Curb Height: 12 inches (305 mm) from finished surface of roof, minimum.
- D. Metal Covers: Flush, insulated, hollow metal construction.
1. Capable of supporting 40 psf (1.92 kPa) live load.
 2. Material: Galvanized steel; outer cover 14 gage, 0.0747 inch (1.90 mm) thick, liner 22 gage, 0.03 inch (0.76 mm) thick.
 3. Finish: Factory prime paint.
 4. Insulation: Manufacturer's standard 2 inches (50 mm) rigid glass fiber.
 5. Gasket: Neoprene, continuous around cover perimeter.
- E. Hardware: Steel, zinc coated and chromate sealed, unless otherwise indicated or required by manufacturer.
1. Lifting Mechanisms: Compression or torsion spring operator with shock absorbers that automatically opens upon release of latch; capable of lifting covers despite 10 psf (475 kPa) load.
 2. Hinges: Manufacturer's recommended type.
 3. Hold open arm with vinyl-coated handle for manual release.
 4. Latch: Upon closing, engage latch automatically and reset manual release.
 5. Manual Release: Pull handle on interior.
 6. Locking: Padlock hasp on interior.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions, in manner that maintains roofing weather integrity.

3.03 CLEANING

- A. Clean installed work to like-new condition.

3.04 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 07 8400

FIRESTOPPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Firestopping systems.
- B. Firestopping of all joints and penetrations in fire resistance rated and smoke resistant assemblies, whether indicated on drawings or not, and other openings indicated.

1.02 RELATED REQUIREMENTS

- A. Section 01 7000 - Execution and Closeout Requirements: Cutting and patching.
- B. Section 09 2116 - Gypsum Board Assemblies: Gypsum wallboard fireproofing.

1.03 REFERENCE STANDARDS

- A. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2015.
- B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2013a.
- C. ASTM E1966 - Standard Test Method for Fire Resistive Joint Systems; 2007 (Reapproved 2011).
- D. ASTM E2174 - Standard Practice for On-Site Inspection of Installed Firestops; 2014.
- E. ASTM E2393 - Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers; 2010a.
- F. ASTM E2307 - Standard Test Method for Determining Fire Resistance of Perimeter Fire Barriers Using Intermediate-Scale, Multi-story Test Apparatus; 2015a.
- G. ASTM E2837 - Standard Test Method for Determining the Fire Resistance of Continuity Head-of-Wall Joint Systems Installed Between Rated Wall Assemblies and Nonrated Horizontal Assemblies; 2013.
- H. ITS (DIR) - Directory of Listed Products; Intertek Testing Services NA, Inc.; current edition.
- I. FA (AG) - FM Approval Guide; Factory Mutual Research Corporation; current edition.
- J. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.
- K. UL (FRD) - Fire Resistance Directory; Underwriters Laboratories Inc.; current edition.

1.04 QUALITY ASSURANCE

- A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Installer Qualifications: Company specializing in performing the work of this section and:
 - 1. With minimum 3 years documented experience installing work of this type.

1.05 FIELD CONDITIONS

- A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation. Maintain minimum temperature before, during, and for 3 days after installation of materials.
- B. Provide ventilation in areas where solvent-cured materials are being installed.

PART 2 PRODUCTS

2.01 FIRESTOPPING - GENERAL REQUIREMENTS

- A. Manufacturers:
 - 1. A/D Fire Protection Systems Inc.; ____: www.adfire.com.

2. 3M Fire Protection Products; _____: www.3m.com/firestop.
 3. Hilti, Inc: www.us.hilti.com/#sle.
 4. Nelson FireStop Products; _____: www.nelsonfirestop.com.
 5. Specified Technologies, Inc.; _____: www.stifirestop.com.
- B. Firestopping: Any material meeting requirements.
 - C. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Type required for tested assembly design.
 - D. Fire Ratings: Refer to drawings for required systems and ratings.

2.02 FIRESTOPPING ASSEMBLY REQUIREMENTS

- A. Perimeter Fire Containment Firestopping: Use any system that has been tested according to ASTM E2307 to have fire resistance F Rating equal to required fire rating of the floor assembly.
- B. Head-of-Wall Firestopping at Joints Between Non-Rated Floor and Fire-Rated Wall: Use any system that has been tested according to ASTM E2837 to have fire resistance F Rating equal to required fire rating of floor or wall, whichever is greater.
- C. Floor-to-Floor, Wall-to-Wall, and Wall-to-Floor Joints, Except Perimeter, Where Both Are Fire-Rated: Use any system that has been tested according to ASTM E1966 or UL 2079 to have fire resistance F Rating equal to required fire rating of the assembly in which the joint occurs.
- D. Through Penetration Firestopping: Use any system that has been tested according to ASTM E814 to have fire resistance F Rating equal to required fire rating of penetrated assembly.

2.03 FIRESTOPPING FOR FLOOR-TO-FLOOR, WALL-TO-FLOOR, AND WALL-TO-WALL JOINTS

- A. Concrete and Concrete Masonry Walls and Floors:
 1. Floor to Floor Joints:
 - a. 2 Hour Construction: UL System FF-D-1013; Hilti CFS-SP WB Firestop Joint Spray and CP 672.
 2. Concrete/Concrete Masonry Wall to Wall Joints:
 - a. 2 Hour Construction: UL System WW-D-0017; Hilti CFS-SP WB Firestop Joint Spray and CP 672.
- B. Gypsum Board Walls:
 1. Wall to Wall Joints:
 - a. 2 Hour Construction: UL System WW-D-0067; Hilti CP 606 Flexible Firestop Sealant.
 - b. 1 Hour Construction: UL System WW-D-0067; Hilti CP 606 Flexible Firestop Sealant.

2.04 FIRESTOPPING PENETRATIONS THROUGH CONCRETE AND CONCRETE MASONRY CONSTRUCTION

- A. Blank Openings:
 1. In Floors or Walls:
 - a. 2 Hour Construction: UL System C-AJ-0090; Hilti FS-ONE MAX Intumescent Firestop Sealant.
- B. Penetrations Through Floors or Walls By:
 1. Multiple Penetrations in Large Openings:
 - a. 2 Hour Construction: UL System C-AJ-8143; Hilti FS-ONE MAX Intumescent Firestop Sealant.
 2. Uninsulated Metallic Pipe, Conduit, and Tubing:
 - a. 2 Hour Construction: UL System C-AJ-1226; Hilti FS-ONE MAX Intumescent Firestop Sealant.
 - b. 2 Hour Construction: UL System C-AJ-1425; Hilti CFS-S SIL GG Firestop Silicone Sealant Gun-Grade.
- C. Penetrations Through Floors By:
 1. Multiple Penetrations in Large Openings:

- a. 2 Hour Construction: UL System F-A-8012; Hilti CFS-S SIL GG Firestop Silicone Sealant Gun-Grade or CFS-S SIL SL Firestop Silicone Sealant Self-Leveling.
- 2. Uninsulated Metallic Pipe, Conduit, and Tubing:
 - a. 2 Hour Construction: UL System F-A-1016; Hilti CP 680-P/M Cast-In Device.
- 3. Electrical Cables Not In Conduit:
 - a. 2 Hour Construction: UL System F-A-3033; Hilti CP 680-P/M Cast-In Device.
- 4. Electrical Busways:
 - a. 2 Hour Construction: UL System F-A-6002; Hilti CP 604 Self-Leveling Firestop Sealant.
- 5. Insulated Pipes:
 - a. 2 Hour Construction: UL System F-A-5015; Hilti CP 680-P/M Cast-In Device.
- D. Penetrations Through Walls By:
 - 1. Uninsulated Metallic Pipe, Conduit, and Tubing:
 - a. 2 Hour Construction: UL System W-J-1067; Hilti FS-ONE MAX Intumescent Firestop Sealant.
 - b. 1 Hour Construction: UL System W-J-1067; Hilti FS-ONE MAX Intumescent Firestop Sealant.
 - 2. Electrical Cables Not In Conduit:
 - a. 2 Hour Construction: UL System C-AJ-3095; Hilti FS-ONE MAX Intumescent Firestop Sealant.
 - 3. Insulated Pipes:
 - a. 2 Hour Construction: UL System C-AJ-5090; Hilti FS-ONE MAX Intumescent Firestop Sealant.
 - b. 1 Hour Construction: UL System C-AJ-5090; Hilti FS-ONE MAX Intumescent Firestop Sealant.
 - 4. HVAC Ducts, Uninsulated:
 - a. 2 Hour Construction: UL System W-J-7109; Hilti FS-ONE MAX Intumescent Firestop Sealant or CP 606 Flexible Firestop Sealant.
 - 5. HVAC Ducts, Insulated:
 - a. 2 Hour Construction: UL System W-J-7112; Hilti FS-ONE MAX Intumescent Firestop Sealant.

2.05 FIRESTOPPING PENETRATIONS THROUGH GYPSUM BOARD WALLS

- A. Blank Openings:
 - 1. 2 Hour Construction: UL System W-L-3334; Hilti CP 653 Speed Sleeve.
 - 2. 1 Hour Construction: UL System W-L-3334; Hilti CP 653 Speed Sleeve.
- B. Penetrations By:
 - 1. Multiple Penetrations in Large Openings:
 - a. 2 Hour Construction: UL System W-L-1408; Hilti FS-ONE MAX Intumescent Firestop Sealant.
 - b. 1 Hour Construction: UL System W-L-1408; Hilti FS-ONE MAX Intumescent Firestop Sealant.
 - 2. Uninsulated Metallic Pipe, Conduit, and Tubing:
 - a. 2 Hour Construction: UL System W-L-1054; Hilti FS-ONE MAX Intumescent Firestop Sealant.
 - b. 1 Hour Construction: UL System W-L-1054; Hilti FS-ONE MAX Intumescent Firestop Sealant.
 - 3. Electrical Cables Not In Conduit:
 - a. 2 Hour Construction: UL System W-L-3065; Hilti FS-ONE MAX Intumescent Firestop Sealant, CP 606 Flexible Firestop Sealant, CD 601S Elastomeric Firestop Sealant, or CP 618 Firestop Putty Stick.
 - b. 1 Hour Construction: UL System W-L-3393; Hilti CFS-SL RK Retrofit Sleeve Kit for existing cables.
 - 4. Cable Trays with Electrical Cables:

- a. 2 Hour Construction: UL System W-L-4011; Hilti CFS-BL Firestop Block.
- b. 1 Hour Construction: UL System W-L-4011; Hilti CFS-BL Firestop Block.
- 5. Insulated Pipes:
 - a. 2 Hour Construction: UL System W-L-5028; Hilti FS-ONE MAX Intumescent Firestop Sealant.
 - b. 1 Hour Construction: UL System W-L-5028; Hilti FS-ONE MAX Intumescent Firestop Sealant.
- 6. HVAC Ducts, Insulated:
 - a. 2 Hour Construction: UL System W-L-7156; Hilti FS-ONE MAX Intumescent Firestop Sealant.
 - b. 1 Hour Construction: UL System W-L-7156; Hilti FS-ONE MAX Intumescent Firestop Sealant.

2.06 FIRESTOPPING SYSTEMS

- A. Firestopping: Any material meeting requirements.
 - 1. Fire Ratings: Use any system that is listed by FM, ITS (DIR), or UL (FRD) and tested in accordance with ASTM E814 or ASTM E119 with F Rating equal to fire rating of penetrated assembly and minimum T Rating Equal to F Rating and in compliance with other specified requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify openings are ready to receive the work of this section.

3.02 PREPARATION

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter that could adversely affect bond of firestopping material.
- B. Remove incompatible materials that could adversely affect bond.

3.03 INSTALLATION

- A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.
- B. Do not cover installed firestopping until inspected by authorities having jurisdiction.
- C. Install labeling required by code.

3.04 CLEANING

- A. Clean adjacent surfaces of firestopping materials.

3.05 PROTECTION

- A. Protect adjacent surfaces from damage by material installation.

END OF SECTION

SECTION 07 9200
JOINT SEALANTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Nonsag gunnable joint sealants.
- B. Joint backings and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 07 2500 - Weather Barriers: Sealants required in conjunction with air barriers and vapor retarders.
- B. Section 07 8400 - Firestopping: Firestopping sealants.
- C. Section 08 7100 - Door Hardware: Setting exterior door thresholds in sealant.
- D. Section 08 8000 - Glazing: Glazing sealants and accessories.
- E. Section 09 2116 - Gypsum Board Assemblies: Sealing acoustical and sound-rated walls and ceilings.
- F. Section 09 3000 - Tiling: Sealant between tile and plumbing fixtures and at junctions with other materials and changes in plane.
- G. Section 23 3100 - HVAC Ducts and Casings: Duct sealants.

1.03 REFERENCE STANDARDS

- A. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer; 2006 (Reapproved 2011).
- B. ASTM C794 - Standard Test Method for Adhesion-In-Peel of Elastomeric Joint Sealants; 2015.
- C. ASTM C834 - Standard Specification for Latex Sealants; 2010.
- D. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications; 2012.
- E. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014.
- F. ASTM C1087 - Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems; 2000 (Reapproved 2011).
- G. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016.
- H. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants; 2008 (Reapproved 2012).
- I. ASTM C1311 - Standard Specification for Solvent Release Sealants; 2010.
- J. SCAQMD 1168 - South Coast Air Quality Management District Rule No.1168; current edition; www.aqmd.gov.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data for Sealants: Submit manufacturer's technical data sheets for each product to be used, that includes the following.
 - 1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
 - 2. List of backing materials approved for use with the specific product.
 - 3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
 - 4. Substrates the product should not be used on.
- C. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.
- D. Preconstruction Laboratory Test Reports: Submit at least four weeks prior to start of installation.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.
- B. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience and approved by manufacturer.
- C. Preconstruction Laboratory Testing: Arrange for sealant manufacturer(s) to test each combination of sealant, substrate, backing, and accessories.
 - 1. Adhesion Testing: In accordance with ASTM C794.
 - 2. Compatibility Testing: In accordance with ASTM C1087.
 - 3. Allow sufficient time for testing to avoid delaying the work.
 - 4. Deliver to manufacturer sufficient samples for testing.
 - 5. Report manufacturer's recommended corrective measures, if any, including primers or techniques not indicated in product data submittals.
 - 6. Testing is not required if sealant manufacturer provides data showing previous testing, not older than 24 months, that shows satisfactory adhesion, lack of staining, and compatibility.
- D. Field Adhesion Test Procedures:
 - 1. Allow sealants to fully cure as recommended by manufacturer before testing.
 - 2. Have a copy of the test method document available during tests.
 - 3. Record the type of failure that occurred, other information required by test method, and the information required on the Field Quality Control Log.
 - 4. If any combination of sealant type and substrate does not show evidence of minimum adhesion or shows cohesion failure before minimum adhesion, report results to Architect.

1.06 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective work within a five year period after Date of Substantial Completion.
- C. Warranty: Include coverage for installed sealants and accessories that fail to achieve watertight seal, exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Nonsag Sealants: Permits application in joints on vertical surfaces without sagging or slumping.
 - 1. BASF Construction Chemicals-Building Systems: www.buildingsystems.basf.com.
 - 2. Bostik Inc: www.bostik-us.com.
 - 3. Dow Corning Corporation: www.dowcorning.com/construction.
 - 4. Hilti, Inc: www.us.hilti.com/#sle.
 - 5. Momentive Performance Materials, Inc (formerly GE Silicones): www.momentive.com.
 - 6. Tremco Global Sealants: www.tremcosealants.com.
 - 7. Sika Corporation: www.usa-sika.com.
 - 8. W.R. Meadows, Inc: www.wrmeadows.com.
 - 9. Substitutions: See Section 01 6000 - Product Requirements.

2.02 JOINT SEALANT APPLICATIONS

- A. Scope:
 - 1. Exterior Joints: Seal open joints, whether or not the joint is indicated on the drawings, unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to, the following items.
 - a. Wall expansion and control joints.
 - b. Joints between door, window, and other frames and adjacent construction.
 - c. Joints between different exposed materials.
 - d. Openings below ledge angles in masonry.
 - e. Other joints indicated below.

2. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.
 - a. Joints between door, window, and other frames and adjacent construction.
 - b. In sound-rated wall and ceiling assemblies, gaps at electrical outlets, wiring devices, piping, and other openings; between wall/ceiling and other construction; and other flanking sound paths.
 - c. Other joints indicated below.
3. Do not seal the following types of joints.
 - a. Intentional weepholes in masonry.
 - b. Joints indicated to be treated with manufactured expansion joint cover or some other type of sealing device.
 - c. Joints where sealant is specified to be provided by manufacturer of product to be sealed.
 - d. Joints where installation of sealant is specified in another section.
 - e. Joints between suspended panel ceilings/grid and walls.
- B. Exterior Joints: Use nonsag non-staining silicone sealant, Type Grade NS, unless otherwise indicated.
 1. Lap Joints in Sheet Metal Fabrications: Butyl rubber, non-curing; Type as recommended by metal component manufacturer.
- C. Interior Joints: Use nonsag polyurethane sealant, Type as recommended by component manufacturer, unless otherwise indicated.
 1. Wall and Ceiling Joints in Non-Wet Areas: Acrylic emulsion latex sealant.
 2. Wall and Ceiling Joints in Wet Areas: Nonsag polyurethane sealant for continuous liquid immersion.
 3. Floor Joints in Wet Areas: Nonsag polyurethane "nontraffic-grade" sealant suitable for continuous liquid immersion.
 4. Joints between Fixtures in Wet Areas and Floors, Walls, and Ceilings: Mildew-resistant silicone sealant; white.
 5. In Sound-Rated Assemblies: Acrylic emulsion latex sealant.
- D. Interior Wet Areas: Bathrooms, restrooms, kitchens, food service areas, and food processing areas; fixtures in wet areas include plumbing fixtures, food service equipment, countertops, cabinets, and other similar items.
- E. Sound-Rated Assemblies: Walls and ceilings identified as "STC-rated", "sound-rated", or "acoustical".

2.03 JOINT SEALANTS - GENERAL

- A. Sealants and Primers: Provide products having lower volatile organic compound (VOC) content than indicated in South Coast Air Quality Management District (SCAQMD); Rule 1168.
- B. Colors: As indicated on the drawings or to match adjacent component finish.

2.04 NONSAG JOINT SEALANTS

- A. Non-Staining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
 1. Movement Capability: Plus and minus 50 percent, minimum.
 2. Non-Staining To Porous Stone: Non-staining to light-colored natural stone when tested in accordance with ASTM C1248.
 3. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.
 4. Hardness Range: 15 to 35, Shore A, when tested in accordance with ASTM C661.
 5. Color: Match adjacent finished surfaces.
 6. Cure Type: Single-component, neutral moisture curing.
- B. Mildew-Resistant Silicone Sealant: ASTM C920, Grade NS, Uses M and A; single component, mildew resistant; not expected to withstand continuous water immersion or traffic.
 1. Color: To match adjacent component finish.

- C. Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multicomponent; not expected to withstand continuous water immersion or traffic.
 - 1. Movement Capability: Plus and minus 25 percent, minimum.
- D. Polyurethane Sealant for Continuous Water Immersion: ASTM C920, Grade NS, Uses M and A; single or multicomponent; explicitly approved by manufacturer for continuous water immersion; suitable for traffic exposure when recessed below traffic surface .
 - 1. Movement Capability: Plus and minus 35 percent, minimum.
 - 2. Color: Match adjacent finished surfaces.
- E. Acrylic Emulsion Latex: Water-based; ASTM C834, single component, non-staining, non-bleeding, non-sagging; not intended for exterior use.
- F. Non-Curing Butyl Sealant: Solvent-based; ASTM C1311; single component, nonsag, non-skinning, non-hardening, non-bleeding; vapor-impermeable; intended for fully concealed applications.

2.05 ACCESSORIES

- A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.
- B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.
- C. Masking Tape: Self-adhesive, nonabsorbent, non-staining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.
- D. Joint Cleaner: Non-corrosive and non-staining type, type recommended by sealant manufacturer; compatible with joint forming materials.
- E. Primers: Type recommended by sealant manufacturer to suit application; non-staining.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that joints are ready to receive work.
- B. Verify that backing materials are compatible with sealants.
- C. Verify that backer rods are of the correct size.

3.02 PREPARATION

- A. Remove loose materials and foreign matter that could impair adhesion of sealant.
- B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.
- C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
- D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.

3.03 INSTALLATION

- A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- B. Perform installation in accordance with ASTM C1193.
- C. Perform acoustical sealant application work in accordance with ASTM C919.
- D. Install bond breaker backing tape where backer rod cannot be used.
- E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.
- F. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.

- G. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

END OF SECTION

SECTION 08 1113
HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Non-fire-rated hollow metal doors and frames.
- B. Hollow metal frames for wood doors.
- C. Fire-rated hollow metal doors and frames.
- D. Thermally insulated hollow metal doors with frames.
- E. Hollow metal borrowed lites glazing frames.

1.02 RELATED REQUIREMENTS

- A. Section 08 7100 - Door Hardware.
- B. Section 08 8000 - Glazing: Glass for doors and borrowed lites.
- C. Section 09 9113 - Exterior Painting: Field painting.
- D. Section 09 9123 - Interior Painting: Field painting.

1.03 ABBREVIATIONS AND ACRONYMS

- A. ANSI - American National Standards Institute.
- B. HMMA - Hollow Metal Manufacturers Association.
- C. NAAMM - National Association of Architectural Metal Manufacturers.
- D. NFPA - National Fire Protection Association.
- E. SDI - Steel Door Institute.
- F. UL - Underwriters Laboratories.

1.04 REFERENCE STANDARDS

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- B. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors; 2011.
- C. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2014.
- D. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2011.
- E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.
- F. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable; 2015.
- G. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2014.
- H. BHMA A156.115 - American National Standard for Hardware Preparation in Steel Doors and Steel Frames; 2014.
- I. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2009.
- J. ITS (DIR) - Directory of Listed Products; current edition.
- K. NAAMM HMMA 805 - Recommended Selection and Usage Guide for Hollow Metal Doors and Frames; 2012.
- L. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames; 2002.
- M. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames; 2011.

- N. NAAMM HMMA 840 - Guide Specifications for Installation and Storage of Hollow Metal Doors and Frames; 2007.
- O. NAAMM HMMA 850 - Fire-Protection and Smoke Control Rated Hollow Metal Door and Frame Products; 2014.
- P. NAAMM HMMA 860 - Guide Specifications for Hollow Metal Doors and Frames; 2013.
- Q. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2016.
- R. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2012.
- S. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.
- T. UL 10B - Standard for Fire Tests of Door Assemblies; Current Edition, Including All Revisions.
- U. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.
- C. Manufacturer's Certificate: Certification that products meet or exceed specified requirements.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum 5 years documented experience.
- B. Copies of Documents at Project Site: Maintain at the project site a copy of each referenced document that prescribes installation requirements.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
- B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Hollow Metal Doors and Frames:
 - 1. Ceco Door, an Assa Abloy Group company; ____: www.assaabloydss.com.
 - 2. De La Fontaine Inc; Hollow Metal Door Model ____: www.delafontaine.com.
 - 3. Republic Doors; ____: www.republicdoor.com.
 - 4. Steelcraft, an Allegion brand; ____: www.allegion.com/us.
 - 5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 DESIGN CRITERIA

- A. Requirements for Hollow Metal Doors and Frames:
 - 1. Steel used for fabrication of doors and frames shall comply with one or more of the following requirements; Galvannealed steel conforming to ASTM A653/A653M, cold-rolled steel conforming to ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel conforming to ASTM A1011/A1011M, Commercial Steel (CS) Type B for each.
 - 2. Accessibility: Comply with ICC A117.1 and ADA Standards.
 - 3. Door Edge Profile: Beveled, both sides.
 - 4. Typical Door Face Sheets: Flush.
 - 5. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.

- B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.03 HOLLOW METAL DOORS

- A. Exterior Doors: Thermally insulated.
1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
 - a. Level 3 - Extra Heavy-duty.
 - b. Physical Performance Level A, 1,000,000 cycles; in accordance with ANSI/SDI A250.4.
 - c. Model 1 - Full Flush.
 - d. Door Face Metal Thickness: 16 gage, 0.053 inch (1.3 mm), minimum.
 - e. Zinc Coating: A60/ZF180 galvanized coating; ASTM A653/A653M.
 2. Core Material: Polyisocyanurate, 2 lbs/cu ft minimum density.
 3. Door Thermal Resistance: R-Value of 9.9, minimum, for installed thickness of polyisocyanurate.
 4. Door Thickness: 1-3/4 inch (44.5 mm), nominal.
 5. Top Closures for Outswinging Doors: Flush with top of faces and edges.
 6. Weatherstripping: Refer to Section 08 7100.
 7. Door Finish: Factory primed and field finished.
- B. Interior Doors, Non-Fire Rated:
1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
 - a. Level 3 - Extra Heavy-duty.
 - b. Physical Performance Level A, 1,000,000 cycles; in accordance with ANSI/SDI A250.4.
 - c. Model 1 - Full Flush.
 - d. Door Face Metal Thickness: 16 gage, 0.053 inch (1.3 mm), minimum.
 2. Core Material: Manufacturers standard core material/construction and in compliance with requirements.
 3. Door Thickness: 1-3/4 inch (44.5 mm), nominal.
 4. Door Finish: Factory primed and field finished.
- C. Fire-Rated Doors:
1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
 - a. Level 3 - Extra Heavy-duty.
 - b. Physical Performance Level A, 1,000,000 cycles; in accordance with ANSI/SDI A250.4.
 - c. Model 1 - Full Flush.
 - d. Door Face Metal Thickness: 16 gage, 0.053 inch (1.3 mm), minimum.
 2. Fire Rating: As indicated on Door Schedule, tested in accordance with UL 10C and NFPA 252 ("positive pressure fire tests").
 3. Provide units listed and labeled by UL (DIR) or ITS (DIR).
 - a. Attach fire rating label to each fire rated unit.
 4. Door Thickness: 1-3/4 inch (44.5 mm), nominal.

2.04 HOLLOW METAL FRAMES

- A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.
- B. Exterior Door Frames: Full profile/continuously welded type.
1. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvanized) in accordance with ASTM A653/A653M, with A40/ZF120 coating.
 2. Frame Metal Thickness: 14 gage, 0.067 inch (1.7 mm), minimum.
 3. Frame Finish: Factory primed and field finished.

- 4. Weatherstripping: Separate, see Section 08 7100.
- C. Interior Door Frames, Non-Fire Rated: Knock-down type.
 - 1. Frame Metal Thickness: 14 gage, 0.067 inch (1.7 mm), minimum.
 - 2. Frame Finish: Factory primed and field finished.
- D. Door Frames, Fire-Rated: Knock-down type.
 - 1. Fire Rating: Same as door, labeled.
 - 2. Frame Metal Thickness: 14 gage, 0.067 inch (1.7 mm), minimum.
 - 3. Frame Finish: Factory primed and field finished.
- E. Frames for Wood Doors: Comply with frame requirements in accordance with corresponding door.
- F. Mullions for Pairs of Doors: Removable type, with profile similar to jambs.
- G. Borrowed Lites Glazing Frames: Construction and face dimensions to match door frames, and as indicated on drawings.
- H. Provide mortar guard boxes for hardware cut-outs in frames to be installed in masonry or to be grouted.
- I. Frames in Masonry Walls: Size to suit masonry coursing with head member 4 inch high (102 mm high) to fill opening without cutting masonry units.
- J. Frames Wider than 48 Inch (1219 mm): Reinforce with steel channel fitted tightly into frame head, flush with top.
- K. Frames Installed Back-to-Back: Reinforce with steel channels anchored to floor and overhead structure.

2.05 ACCESSORIES

- A. Glazing: As specified in Section 08 8000, factory installed.
- B. Removable Stops: Formed sheet steel, shape as indicated on drawings, mitered or butted corners; prepared for countersink style tamper proof screws.
- C. Grout for Frames: Portland cement grout with maximum 4 inch (102 mm) slump for hand troweling; thinner pumpable grout is prohibited.
- D. Silencers: Resilient rubber, fitted into drilled hole; 3 on strike side of single door, 3 on center mullion of pairs, and 2 on head of pairs without center mullions.
- E. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

2.06 FINISHES

- A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.
- B. Bituminous Coating: Asphalt emulsion or other high-build, water-resistant, resilient coating.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Verify that finished walls are in plane to ensure proper door alignment.

3.02 PREPARATION

- A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.

3.03 INSTALLATION

- A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.
- B. Install fire rated units in accordance with NFPA 80.
- C. Coordinate frame anchor placement with wall construction.

- D. Grout frames in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.
- E. Coordinate installation of hardware.
- F. Coordinate installation of glazing.
- G. Coordinate installation of electrical connections to electrical hardware items.
- H. Touch up damaged factory finishes.

3.04 TOLERANCES

- A. Clearances Between Door and Frame: Comply with related requirements of specified door and frame standards or custom guidelines indicated.
- B. Maximum Diagonal Distortion: 1/16 in (1.5 mm) measured with straight edge, corner to corner.

3.05 ADJUSTING

- A. Adjust for smooth and balanced door movement.

3.06 SCHEDULE

- A. Refer to Door and Frame Schedule on the drawings.

END OF SECTION

SECTION 08 1416
FLUSH WOOD DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Flush wood doors; flush and flush glazed configuration; fire rated, non-rated, and special function.

1.02 RELATED REQUIREMENTS

- A. Section 08 1113 - Hollow Metal Doors and Frames.
- B. Section 08 7100 - Door Hardware.
- C. Section 08 8000 - Glazing.
- D. Section 09 2116 - Gypsum Board Assemblies: Bullet-resistant sheathing and wallboard for bullet-resistant partitions and walls.
- E. Section 09 9123 - Interior Painting: Field finishing of doors.

1.03 REFERENCE STANDARDS

- A. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2012.
- B. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.
- C. ICC (IBC) - International Building Code; 2015.
- D. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; National Fire Protection Association; 2016.
- E. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association; 2012.
- F. UL 10B - Standard for Fire Tests of Door Assemblies; Current Edition, Including All Revisions.
- G. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.
- H. WDMA I.S. 1A - Interior Architectural Wood Flush Doors; Window and Door Manufacturers Association; 2013. (ANSI/WDMA I.S. 1A)

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.
- C. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and other details.
- D. Specimen warranty.
- E. Samples: Submit two samples of door veneer, 4 by 4 inch (____ by ____ mm) in size illustrating wood grain, stain color, and sheen.
- F. Manufacturer's Installation Instructions: Indicate special installation instructions.
- G. Warranty, executed in Owner's name.

1.05 QUALITY ASSURANCE

- A. Maintain one copy of the specified door quality standard on site for review during installation and finishing.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum 5 years of documented experience.
- C. Installed Fire Rated Door Assembly: Conform to NFPA 80 for fire-rating as indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Package, deliver and store doors in accordance with specified quality standard.
- B. Accept doors on site in manufacturer's packaging. Inspect for damage.
- C. Protect doors with resilient packaging sealed with heat shrunk plastic. Do not store in damp or wet areas; or in areas where sunlight might bleach veneer. Seal top and bottom edges with tinted sealer if stored more than one week. Break seal on site to permit ventilation.

1.07 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Interior Doors: Provide manufacturer's warranty for the life of the installation.
- C. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Wood Veneer Faced Doors:
 - 1. Eggers Industries; ____: www.eggersindustries.com.
 - 2. Graham Wood Doors; ____: www.grahamdoors.com.
 - 3. Haley Brothers; ____: www.haleybros.com.
 - 4. Marshfield DoorSystems, Inc; ____: www.marshfielddoors.com.
 - 5. Oregon Door; Architectural Series: www.oregondoor.com.
 - 6. Substitutions: See Section 01 6000 - Product Requirements.

2.02 DOORS

- A. Doors: See drawings for locations and additional requirements.
 - 1. Quality Level: Custom Grade, Heavy Duty performance, in accordance with AWI/AWMAC/WI (AWS).
 - 2. Wood Veneer Faced Doors: 5-ply unless otherwise indicated.
- B. Interior Doors: 1-3/4 inches (44 mm) thick unless otherwise indicated; flush construction.
 - 1. Provide solid core doors at each location.
 - 2. Fire Rated Doors: Tested to 20 minutes, 60 minutes, 90 minutes, and ratings as indicated on drawings in accordance with UL 10C - Positive Pressure; Underwriters Laboratories Inc. (UL) or Intertek/Warnock Hersey (WHI) labeled without any visible seals when door is open.
 - 3. Wood veneer facing with factory transparent finish on Maple veneer with satin sheen.

2.03 DOOR AND PANEL CORES

- A. Non-Rated Solid Core and 20 Minute Rated Doors: Type particleboard core (PC), plies and faces as indicated.
- B. Fire Rated Doors: Mineral core type, with fire resistant composite core (FD), plies and faces as indicated above; with core blocking as required to provide adequate anchorage of hardware without through-bolting.

2.04 DOOR FACINGS

- A. Veneer Facing for Transparent Finish: Species as specified above, veneer grade in accordance with quality standard indicated, plain sliced (flat cut), with book match between leaves of veneer, running match of spliced veneer leaves assembled on door or panel face.
 - 1. Vertical Edges: Any option allowed by quality standard for grade.
 - 2. "Pair Match" each pair of doors; "Set Match" pairs of doors within 10 feet (3 m) of each other when doors are closed.

2.05 ACCESSORIES

- A. Hollow Metal Door Frames: As specified in Section 08 1113.
- B. Glazed Openings:

1. Heat-Strengthened and Fully Tempered Glass: ASTM C1048.
- C. Glazing Stops: Rolled steel channel shape, mitered corners; prepared for countersink style tamper proof screws.
- D. Astragals for Non-Rated Double Doors: Steel, T shaped, overlapping and recessed at face edge.
- E. Astragals for Fire Rated Double Doors: Steel, T shaped, overlapping and recessed at face edge, specifically for double doors.
- F. Door Hardware: As specified in Section 08 7100.

2.06 DOOR CONSTRUCTION

- A. Fabricate doors in accordance with door quality standard specified.
- B. Cores Constructed with stiles and rails:
 1. Provide solid blocks at lock edge for hardware reinforcement.
 2. Provide solid blocking for other throughbolted hardware.
- C. Where supplementary protective edge trim is required, install trim after veneer facing has been applied full-width.
- D. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.
- E. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.
- F. Provide edge clearances in accordance with the quality standard specified.

2.07 FACTORY FINISHING - WOOD VENEER DOORS

- A. Factory finish doors in accordance with approved sample.
- B. Seal door top edge with color sealer to match door facing.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.02 INSTALLATION

- A. Install doors in accordance with manufacturer's instructions and specified quality standard.
 1. Install fire-rated doors in accordance with NFPA 80 requirements.
- B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.
- C. Use machine tools to cut or drill for hardware.
- D. Coordinate installation of doors with installation of frames and hardware.
- E. Coordinate installation of glazing.

3.03 TOLERANCES

- A. Conform to specified quality standard for fit and clearance tolerances.
- B. Conform to specified quality standard for telegraphing, warp, and squareness.

3.04 ADJUSTING

- A. Adjust doors for smooth and balanced door movement.
- B. Adjust closers for full closure.

3.05 SCHEDULE - SEE DRAWINGS

END OF SECTION

SECTION 08 4229
AUTOMATIC ENTRANCES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Packaged power-operated door assemblies.
- B. Controllers, actuators and safety devices.
- C. Maintenance.

1.02 RELATED REQUIREMENTS

- A. Section 26 2717 - Equipment Wiring.
- B. Section 28 1300 - Access Control: Connection to access control system; access control devices used as actuators.
- C. Section 28 3100 - Fire Detection and Alarm: Connection to fire alarm system.

1.03 REFERENCE STANDARDS

- A. BHMA A156.10 - American National Standard for Power Operated Pedestrian Doors; Builders Hardware Manufacturers Association; 2011 (ANSI/BHMA A156.10).
- B. NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association; 2014.
- C. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings:
- C. Product Data: Provide data on system components, sizes, features, and finishes.
- D. Maintenance Contract.
- E. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 6000 - Product Requirements, for additional provisions.
 - 2. Wrenches and other tools required for maintenance of equipment.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than 5 years of documented experience.
- B. Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years of experience.

1.06 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Provide 5 year manufacturer warranty.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Sliding Automatic Entrance Door Assemblies: Basis of Design.
 - 1. Besam SL-500 Unislide OC-S, overhead concealed operator, narrow style sliding door system with EcoDoor package including 1" insulated glazing system.
 - 2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 POWER OPERATED DOORS

- A. Power Operated Doors: Provide products that comply with the requirements of the authorities having jurisdiction; unless otherwise indicated, provide equipment selected for the actual weight of the doors and for medium to heavy pedestrian traffic.
 - 1. Sliding and Folding Door Operators: In the event of power failure, provide for manual open, close, and break-away operation of door leaves.
 - 2. Packaged Door Assemblies: Provide all components by single manufacturer, factory-assembled, including doors, frames, operators, actuators, and safeties.
 - a. Finish exposed equipment components to match door and frame finish.
 - 3. Exterior and Vestibule Doors: Provide equipment suitable for operating temperature range of minus 20 to plus 140 degrees F (minus 7 to plus 60 degrees C) ambient.
- B. Sliding and Folding Doors with Full Power Operators: Comply with BHMA A156.10; safeties required; provide break-away operation unless otherwise indicated; in the event of break-away operation, interrupt power operation.

2.03 PACKAGED AUTOMATIC ENTRANCE DOOR ASSEMBLIES

- A. Sliding Automatic Door: Single leaf track-mounted, electric operation, extruded aluminum glazed door, with frame, and operator concealed overhead.
 - 1. Operation: Power open, hydraulic close operation.
 - 2. "Outside and Inside" Side Actuator/Safety: combination K-band microwave technology to detect motion and focused active infrared technology to detect presence combined in a single housing surface mounted on each side of header..
 - 3. Hold Open / Mode Selector: Touch pad switch at interior jamb with visual indication and trouble shooting; this is not a fire-rated door.
 - a. Mode selector control to allow the following functions; "Off", "Exit Only", "Two Way Traffic", "Partial Opening" and "Hold Open".
 - 4. Door and Frame Finish: Anodized, natural.
 - 5. Aluminum guide track and surface mounted threshold with interlocking ADA accessible ramps as provide by door manufacturer..

2.04 CONTROLLERS, ACTUATORS, AND SAFETIES

- A. Controller: Provide microprocessor operated controller for each door.
- B. Comply with BHMA A156.10 for actuator and safety types and zones. See previous section for more information.

2.05 ELECTRICAL CHARACTERISTICS AND COMPONENTS

- A. Electrical Characteristics:
 - 1. 3 amp current draw rated load amperes allowing 5 operators on one 20 amp circuit.
 - 2. Self detecting line voltage capable control. 120VAC with solid earth ground connection for each door volts, single phase, 60 Hz.
 - 3. Wiring: Separate internal channel raceway free from moving parts.
 - 4. Convenience battery shall be concealed in header.
 - 5. Refer to Section 26 2717: Electrical connections.
- B. Motors: NEMA MG 1.
- C. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70.
- D. Disconnect Switch: Factory mount disconnect switch in control panel.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that electric power is available and is of the correct characteristics.

3.02 INSTALLATION

- A. Install equipment in accordance with manufacturer's instructions.

3.03 ADJUSTING

- A. Adjust door equipment for correct function and smooth operation.

3.04 CLEANING

- A. Remove temporary protection, clean exposed surfaces.

3.05 CLOSEOUT ACTIVITIES

- A. Demonstrate operation, operating components, adjustment features, and lubrication requirements.

3.06 MAINTENANCE

- A. Provide service and maintenance of operating equipment for one year from Date of Substantial Completion, at no extra charge to Owner.

END OF SECTION

SECTION 08 4313
ALUMINUM-FRAMED STOREFRONTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Aluminum-framed storefront, with vision glass.
- B. Aluminum doors and frames.
- C. Weatherstripping.

1.02 RELATED REQUIREMENTS

- A. Section 07 9200 - Joint Sealants: Sealing joints between frames and adjacent construction.
- B. Section 08 4229 - Automatic Entrances.
- C. Section 08 7100 - Door Hardware: Hardware items other than specified in this section.
- D. Section 08 8000 - Glazing: Glass and glazing accessories.

1.03 REFERENCE STANDARDS

- A. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site; 2015.
- B. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2012.
- C. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections; 2009.
- D. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels; 2013.
- E. ASCE 7 - Minimum Design Loads for Buildings and Other Structures; 2010, with 2013 Supplements and Errata.
- F. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.
- G. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.
- H. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric]; 2013.
- I. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2004 (Reapproved 2012).
- J. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate with installation of other components that comprise the exterior enclosure.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, internal drainage details and _____.
- C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related Work, expansion and contraction joint location and details, and field welding required.
- D. Design Data: Provide framing member structural and physical characteristics, engineering calculations, and dimensional limitations.
- E. Hardware Schedule: Complete itemization of each item of hardware to be provided for each door, cross-referenced to door identification numbers in Contract Documents. Coordinate with Section 08 7100.

- F. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

- A. Designer Qualifications: Design structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed at the State in which the Project is located.
- B. Manufacturer and Installer Qualifications: Company specializing in manufacturing aluminum glazing systems with minimum 5 years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Handle products of this section in accordance with AAMA CW-10.
- B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.08 FIELD CONDITIONS

- A. Do not install sealants when ambient temperature is less than 40 degrees F (5 degrees C). Maintain this minimum temperature during and 48 hours after installation.

1.09 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.
- C. Provide five year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.
- D. Provide five year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Aluminum-Framed Storefront and Doors:
 - 1. EFCO Corporation; _____: www.efcocorp.com.
 - 2. Kawneer North America; Basis of design is Kawneer 451T storefront system: www.kawneer.com.
 - 3. Oldcastle BuildingEnvelope; _____: www.oldcastlebe.com.
 - 4. Tubelite, Inc.; _____: www.tubeliteinc.com.
 - 5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 STOREFRONT

- A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
 - 1. Glazing Position: Centered (front to back).
 - 2. Vertical and Horizontal Mullion Dimensions: 2 inches wide by 4-1/2 inches deep (50 mm wide by 114 mm deep).
 - 3. Finish: Class I natural anodized.
 - a. Factory finish all surfaces that will be exposed in completed assemblies.
 - 4. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.
 - 5. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
 - 6. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
 - 7. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F (95 degrees C) over a 12 hour

period without causing detrimental effect to system components, anchorages, and other building elements.

8. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
9. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.

2.03 COMPONENTS

- A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.
 1. Glazing Stops: Flush.
 2. Structurally Reinforced Members: Extruded aluminum with internal reinforcement of structural steel member.
- B. Glazing: As specified in Section 08 8000.
- C. Swing Doors: Glazed aluminum. Basis of design is Kawneer 350 standard medium stile entrance doors.
 1. Thickness: 1-3/4 inches (43 mm).
 2. Top Rail: 3-1/2 inches (____ mm) wide.
 3. Vertical Stiles: 3-1/2 inches (____ mm) wide.
 4. Bottom Rail: 6-1/2 inches (____ mm) wide.
 5. Glazing Stops: Square.
 6. Finish: Same as storefront.

2.04 MATERIALS

- A. Extruded Aluminum: ASTM B221 (ASTM B221M).
- B. Fasteners: Stainless steel.
- C. Exposed Flashings: Aluminum sheet, 20 gage, 0.032 inch (0.81 mm) minimum thickness; finish to match framing members.
- D. Concealed Flashings: Sheet aluminum, 26 gage, 0.017 inch (0.43 mm) minimum thickness.
- E. Sill Flashing Sealant: Elastomeric, silicone or polyurethane, compatible with flashing material.
- F. Sealant for Setting Thresholds: Non-curing butyl type.
- G. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.

2.05 FINISHES

- A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils (0.018 mm) thick.
- B. Color: Clear.
- C. Touch-Up Materials: As recommended by coating manufacturer for field application.

2.06 HARDWARE

- A. For each door, include weatherstripping, sill sweep strip, and threshold.
- B. Other Door Hardware: As specified in Section 08 7100.
- C. Weatherstripping: Wool pile, continuous and replaceable; provide on all doors.
- D. Sill Sweep Strips: Resilient seal type, retracting, of neoprene; provide on all doors.
- E. Threshold: Extruded aluminum, one piece per door opening, ribbed surface, to meet ADA accessibility requirements; provide on all exterior doors.
- F. Pivots: Offset type; top and bottom.
 1. Provide on all doors.
- G. Locks: Dead latch with thumbturn inside; keyed cylinder outside.
 1. Provide on all doors.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify dimensions, tolerances, and method of attachment with other work.
- B. Verify that wall openings and adjoining air and vapor seal materials are ready to receive work of this section.

3.02 INSTALLATION

- A. Install wall system in accordance with manufacturer's instructions.
- B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
- C. Provide alignment attachments and shims to permanently fasten system to building structure.
- D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
- E. Provide thermal isolation where components penetrate or disrupt building insulation.
- F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.
- G. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.
- H. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- I. Set thresholds in bed of sealant and secure.
- J. Install hardware using templates provided.
 - 1. See Section 08 7100 for hardware installation requirements.
- K. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 TOLERANCES

- A. Maximum Variation from Plumb: 0.06 inches every 3 ft (1.5 mm/m) non-cumulative or 1/16 inches per 10 ft (1.5 mm/3 m), whichever is less.
- B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch (0.8 mm).

3.04 ADJUSTING

- A. Adjust operating hardware for smooth operation.

3.05 CLEANING

- A. Remove protective material from pre-finished aluminum surfaces.
- B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.

3.06 PROTECTION

- A. Protect installed products from damage during subsequent construction.

END OF SECTION

SECTION 08 5113
ALUMINUM WINDOWS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Extruded aluminum windows with fixed sash.
- B. Factory glazing.

1.02 RELATED REQUIREMENTS

- A. Section 06 1000 - Rough Carpentry: Rough opening framing.
- B. Section 07 2500 - Weather Barriers: Sealing frame to weather barrier installed on adjacent construction.
- C. Section 07 9200 - Joint Sealants: Sealing joints between window frames and adjacent construction.
- D. Section 08 8000 - Glazing.

1.03 REFERENCE STANDARDS

- A. AAMA/WDMA/CSA 101/I.S.2/A440 - North American Fenestration Standard/Specification for windows, doors, and skylights; 2011.
- B. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site; 2015.
- C. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2012.
- D. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels; 2013.
- E. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels; 2013.
- F. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.
- G. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric]; 2013.
- H. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009.
- I. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2004 (Reapproved 2012).
- J. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2009).
- K. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference; 2015.
- L. ASTM E2112 - Standard Practice for Installation of Exterior Windows, Doors and Skylights; 2007.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide component dimensions.
- C. Shop Drawings: Indicate opening dimensions, elevations of different types, framed opening tolerances, method for achieving air and vapor barrier seal to adjacent construction, anchorage locations, standard construction details, and installation requirements.
- D. Grade Substantiation: Prior to submitting shop drawings or starting fabrication, submit one of the following showing compliance with specified grade:

1. Evidence of AAMA Certification.
 2. Evidence of WDMA Certification.
 3. Evidence of CSA Certification.
 4. Test report(s) by independent testing agency itemizing compliance and acceptable to authorities having jurisdiction.
- E. Manufacturer's Installation Instructions: Include complete preparation, installation, and cleaning requirements.

1.05 QUALITY ASSURANCE

- A. Manufacturer and Installer Qualifications: Company specializing in fabrication of commercial aluminum windows of types required, with not fewer than three years of experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of AAMA CW-10.
- B. Protect finished surfaces with wrapping paper or strippable coating during installation. Do not use adhesive papers or sprayed coatings that bond to substrate when exposed to sunlight or weather.

1.07 FIELD CONDITIONS

- A. Do not install sealants when ambient temperature is less than 40 degrees F (5 degrees C).
- B. Maintain this minimum temperature during and 24 hours after installation of sealants.

1.08 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a five year period after the Date of Substantial Completion.
- C. Provide five year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.
- D. Provide five year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design: Quaker Window Products Company, Fixed Window; K200 DS Series.

2.02 WINDOWS

- A. Aluminum Windows: Extruded aluminum frame and sash, factory fabricated, factory finished, with operating hardware, related flashings, and anchorage and attachment devices.
1. Frame Depth: 2-1/2 inches (63.5 mm).
 2. Provide units factory glazed.
 3. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors; fasteners and attachments concealed from view; reinforced as required for operating hardware and imposed loads.
 4. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
 5. Movement: Accommodate movement between window and perimeter framing and deflection of lintel, without damage to components or deterioration of seals.
 6. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
- B. Performance Requirements: Provide products that comply with the following:
1. Grade: AAMA/WDMA/CSA 101/I.S.2/A440 requirements for specific window type:
 - a. Performance Class (PC): CW.
- C. Fixed, Non-Operable Type:
1. Construction: Thermally broken.

2. Glazing: Double; clear; low-e; Minimum U value = 0.35, SHGC = 0.33.
3. Exterior Finish: Class I natural anodized.
4. Interior Finish: Class I natural anodized.

2.03 MATERIALS

- A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.
- B. Principal window frame members shall have a minimum 0.062" wall thickness, which includes all hardware, mounting webs and sectional flanges.
- C. Sills: manufacturer's standard exterior sills, as shown on drawings.
- D. Nailing Fin: manufacturer's standard nailing fin, as shown on drawings.

2.04 FINISHES

- A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils (0.018 mm) thick.
- B. Finish warranty Period: 15 year Superior Performance Organic Coating warranty.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that wall openings and adjoining air and vapor seal materials are ready to receive aluminum windows.

3.02 INSTALLATION

- A. Install windows in accordance with manufacturer's instructions.
- B. Install window assembly in accordance with AAMA/WDMA/CSA 101/I.S.2/A440.
- C. Attach window frame and shims to perimeter opening to accommodate construction tolerances and other irregularities.
- D. Align window plumb and level, free of warp or twist. Maintain dimensional tolerances and alignment with adjacent work.
- E. Install sill and sill end angles.
- F. Provide thermal isolation where components penetrate or disrupt building insulation. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- G. Install glass in accordance with requirements specified in Section 08 8000.
- H. Coordinate window installation with PTAC unit installation.

3.03 TOLERANCES

- A. Maximum Variation from Level or Plumb: 1/16 inches every 3 ft (1.5 mm/m) non-cumulative or 1/8 inches per 10 ft (3 mm/3 m), whichever is less.

3.04 CLEANING

- A. Remove protective material from factory finished aluminum surfaces.
- B. Wash surfaces by method recommended and acceptable to window manufacturer; rinse and wipe surfaces clean.

END OF SECTION

SECTION 08 71 00

DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY:

- A. Section Includes: Finish Hardware for door openings, except as otherwise specified herein.
 - 1. Door hardware for steel (hollow metal) doors.
 - 2. Door hardware for aluminum doors.
 - 3. Door hardware for wood doors.
 - 4. Door hardware for other doors indicated.
 - 5. Keyed cylinders as indicated.
- B. Related Sections:
 - 1. Division 6: Rough Carpentry.
 - 2. Division 8: Aluminum Doors and Frames
 - 3. Division 8: Hollow Metal Doors and Frames.
 - 4. Division 8: Wood Doors.
 - 5. Division 26 Electrical
 - 6. Division 28: Electronic Security
- C. References: Comply with applicable requirements of the following standards. Where these standards conflict with other specific requirements, the most restrictive shall govern.
 - 1. Builders Hardware Manufacturing Association (BHMA)
 - 2. NFPA 101 Life Safety Code
 - 3. NFPA 80 -Fire Doors and Windows
 - 4. ANSI-A156.xx- Various Performance Standards for Finish Hardware
 - 5. UL10C – Positive Pressure Fire Test of Door Assemblies
 - 6. ANSI-A117.1 – Accessible and Usable Buildings and Facilities
 - 7. DHI /ANSI A115.IG – Installation Guide for Doors and Hardware
 - 8. ICC – International Building Code
- D. Intent of Hardware Groups
 - 1. Should items of hardware not definitely specified be required for completion of the Work, furnish such items of type and quality comparable to adjacent hardware and appropriate for service required.
 - 2. Where items of hardware aren't definitely or correctly specified, are required for completion of the Work, a written statement of such omission, error, or other discrepancy to be submitted to Architect, prior to date specified for receipt of bids for clarification by addendum; or, furnish such items in the type and quality established by this specification, and appropriate to the service intended.
- E. Allowances
 - 1. Refer to Division 1 for allowance amount and procedures.
- F. Alternates

1. Refer to Division 1 for Alternates and procedures.
- 1.2 SUBSTITUTIONS:
 - A. Comply with Division 1.
- 1.3 SUBMITTALS:
 - A. Comply with Division 1.
 - B. Special Submittal Requirements: Combine submittals of this Section with Sections listed below to ensure the "design intent" of the system/assembly is understood and can be reviewed together.
 - C. Product Data: Manufacturer's specifications and technical data including the following:
 1. Detailed specification of construction and fabrication.
 2. Manufacturer's installation instructions.
 3. Wiring diagrams for each electric product specified. Coordinate voltage with electrical before submitting.
 4. Submit 6 copies of catalog cuts with hardware schedule.
 5. Provide 9001-Quality Management and 14001-Environmental Management for products listed in Materials Section 2.2
 - D. Shop Drawings - Hardware Schedule: Submit 6 complete reproducible copy of detailed hardware schedule in a vertical format.
 1. List groups and suffixes in proper sequence.
 2. Completely describe door and list architectural door number.
 3. Manufacturer, product name, and catalog number.
 4. Function, type, and style.
 5. Size and finish of each item.
 6. Mounting heights.
 7. Explanation of abbreviations and symbols used within schedule.
 8. Detailed wiring diagrams, specially developed for each opening, indicating all electric hardware, security equipment and access control equipment, and door and frame rough-ins required for specific opening.
 - E. Templates: Submit templates and "reviewed Hardware Schedule" to door and frame supplier and others as applicable to enable proper and accurate sizing and locations of cutouts and reinforcing.
 1. Templates, wiring diagrams and "reviewed Hardware Schedule" of electrical terms to electrical for coordination and verification of voltages and locations.
 - F. Samples: (If requested by the Architect)
 1. 1 sample of Lever and Rose/Escutcheon design, (pair).
 2. 3 samples of metal finishes
 - G. Contract Closeout Submittals: Comply with Division 1 including specific requirements indicated.
 1. Operating and maintenance manuals: Submit 3 sets containing the following.

- a. Complete information in care, maintenance, and adjustment, and data on repair and replacement parts, and information on preservation of finishes.
 - b. Catalog pages for each product.
 - c. Name, address, and phone number of local representative for each manufacturer.
 - d. Parts list for each product.
2. Copy of final hardware schedule, edited to reflect, "As installed".
 3. Copy of final keying schedule
 4. As installed "Wiring Diagrams" for each piece of hardware connected to power, both low voltage and 110 volts.
 5. One set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

1.4 QUALITY ASSURANCE

A. Comply with Division 1.

1. Statement of qualification for distributor and installers.
2. Statement of compliance with regulatory requirements and single source responsibility.
3. Distributor's Qualifications: Firm with 3 years experience in the distribution of commercial hardware.
 - a. Distributor to employ full time Architectural Hardware Consultants (AHC) for the purpose of scheduling and coordinating hardware and establishing keying schedule.
 - b. Hardware Schedule shall be prepared and signed by an AHC.
4. Installer's Qualifications: Firm with 3 years experienced in installation of similar hardware to that required for this Project, including specific requirements indicated.
5. Regulatory Label Requirements: Provide testing agency label or stamp on hardware for labeled openings.
 - a. Provide UL listed hardware for labeled and 20 minute openings in conformance with requirements for class of opening scheduled.
 - b. Underwriters Laboratories requirements have precedence over this specification where conflict exists.
6. Single Source Responsibility: Except where specified in hardware schedule, furnish products of only one manufacturer for each type of hardware.

- ##### B. Review Project for extent of finish hardware required to complete the Work. Where there is a conflict between these Specifications and the existing hardware, notify the Architect in writing and furnish hardware in compliance with the Specification unless otherwise directed in writing by the Architect.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packing and Shipping: Comply with Division 1.

1. Deliver products in original unopened packaging with legible manufacturer's identification.
2. Package hardware to prevent damage during transit and storage.
3. Mark hardware to correspond with "reviewed hardware schedule".
4. Deliver hardware to door and frame manufacturer upon request.

- ##### B. Storage and Protection: Comply with manufacturer's recommendations.

1.6 PROJECT CONDITIONS:

- A. Coordinate hardware with other work. Furnish hardware items of proper design for use on doors and frames of the thickness, profile, swing, security and similar requirements indicated, as necessary for the proper installation and function, regardless of omissions or conflicts in the information on the Contract Documents.
- B. Review Shop Drawings for doors and entrances to confirm that adequate provisions will be made for the proper installation of hardware.

1.7 WARRANTY:

- A. Refer to Conditions of the Contract
- B. Manufacturer's Warranty:
 - 1. Closers: Lifetime
 - 2. Exit Devices: Five Years
 - 3. Locksets & Cylinders: Lifetime
 - 4. Card Locks: Two Year
 - 5. All other Hardware: Two years.

1.8 OWNER'S INSTRUCTION:

- A. Instruct Owner's personnel in operation and maintenance of hardware units.

1.9 MAINTENANCE:

- A. Extra Service Materials: Deliver to Owner extra materials from same production run as products installed. Package products with protective covering and identify with descriptive labels. Comply with Division 1 Closeout Submittals Section.
 - 1. Special Tools: Provide special wrenches and tools applicable to each different or special hardware component.
 - 2. Maintenance Tools: Provide maintenance tools and accessories supplied by hardware component manufacturer.
 - 3. Delivery, Storage and Protection: Comply with Owner's requirements for delivery, storage and protection of extra service materials.
- B. Maintenance Service: Submit for Owner's consideration maintenance service agreement for electronic products installed.

1.10 MATERIALS:

- A. Hinges: Shall be Five Knuckle Ball bearing hinges
 - 1. Template screw hole locations
 - 2. Bearings are to be fully hardened.
 - 3. Bearing shell is to be consistent shape with barrel.
 - 4. Minimum of 2 permanently lubricated non-detachable bearings on standard weight hinge and 4 permanently lubricated bearing on heavy weight hinges.
 - 5. Equip with easily seated, non-rising pins.
 - 6. Non Removable Pin screws shall be slotted stainless steel screws.
 - 7. Hinges shall be full polished, front, back and barrel.
 - 8. Hinge pin is to be fully plated.

9. Bearing assembly is to be installed after plating.
10. Sufficient size to allow 180-degree swing of door
11. Furnish five knuckles with flush ball bearings
12. Provide hinge type as listed in schedule.
13. Furnish 3 hinges per leaf to 7 foot 6 inch height. Add one for each additional 30 inches in height or fraction thereof.
14. Tested and approved by BHMA for all applicable ANSI Standards for type, size, function and finish
15. UL10C listed for Fire rated doors.

B. Geared Continuous Hinges:

1. Tested and approved by BHMA for ANSI A156.26-1996 Grade 1
2. Anti-spinning through fastener
3. UL10C listed for 3 hour Fire rating
4. Non-handed
5. Lifetime warranty
6. Provide Fire Pins for 3-hour fire ratings
7. Sufficient size to permit door to swing 180 degrees

C. Cylindrical Type Locks and Latchsets:

1. Tested and approved by BHMA for ANSI A156.2, Series 4000, Operational Grade 1, Extra-Heavy Duty, and be UL10C listed.
2. Provide 9001-Quality Management and 14001-Environmental Management.
3. Fit modified ANSI A15.2 door preparation.
4. Locksets and cores to be of the same manufacturer to maintain complete lockset warranty
5. Locksets to have anti-rotational studs that are thru-bolted
6. Keyed lever shall not have exposed "keeper" hole
7. Each lever to have independent spring mechanism controlling it
8. 2-3/4 inch (70 mm) backset
9. 9/16 inch (14 mm) throw latchbolt
10. Provide sufficient curved strike lip to protect door trim
11. Outside lever sleeve to be seamless, of one-piece construction made of a hardened steel alloy
12. Keyed lever to be removable only after core is removed, by authorized control key
13. Provide locksets with 7-pin removable and interchangeable core cylinders
14. Hub, side plate, shrouded rose, locking pin to be a one-piece casting with a shrouded locking lug.
15. Locksets outside locked lever must withstand minimum 1400 inch pounds of torque. In excess of that, a replaceable part will shear. Key from outside and inside lever will still operate lockset.
16. Core face must be the same finish as the lockset.
17. Functions and design as indicated in the hardware groups.

D. Cylindrical Grade 2 Type Locks and Latchsets:

1. Certified by BHMA for ANSI A156.3, Series 4000, Operational Grade 2.
2. Fit modified ANSI A15.3 door preparation
3. Locksets and cores to be of the same manufacturer to maintain complete lockset warranty
4. 2-3/4 inch (70mm) backset, or 2 3/8 inch backset as needed

5. 1/2 inch (14mm) throw latchbolt
6. Provide locksets with 7-pin core.
7. Functions and design as indicated in the hardware groups

E. Exit Devices:

1. Exit devices to meet or exceed BHMA for ANSI 156.3, Grade 1.
2. Exit devices to be tested and certified by UL or by a recognized independent laboratory for mechanical operational testing to 10 million cycles minimum with inspection confirming Grade 1 Loaded Forces have been maintained.
3. Exit devices chassis to be investment cast steel, zinc dichromate.
4. Exit devices to have stainless steel deadlocking 3/4" through latch bolt.
5. Exit devices to be equipped with sound dampening on touchbar.
6. Non-fire rated exit devices to have cylinder dogging.
7. Non-fire rated exit devices to have 1/4" minimum turn hex key dogging.
8. Touchpad to be "T" style constructed of architectural metal with matching metal end caps.
9. Touchbar assembly on wide style exit devices to have a 1/4" clearance to allow for vision frames.
10. All exposed exit device components to be of architectural metals and "true" architectural finishes.
11. Provide strikes as required by application.
12. Fire exit hardware to conform to UL10C and UBC 7-2. UL tested for Accident Hazard.
13. The strike is to be black powder coated finish.
14. Exit devices to have field reversible handing.
15. Provide heavy duty vandal resistant lever trim with heavy duty investment cast stainless steel components and extra strength shock absorbing overload springs. Lever shall not require resetting. Lever design to match locksets and latchsets.
16. Provide 9001-Quality Management and 14001-Environmental Management.
17. Vertical Latch Assemblies to have gravity operation, no springs.
18. Approved Manufacturers
 - a. The following manufacturers will be approved contingent on meeting or exceeding the above performance criteria:
 - 1) Precision Manufactured by Stanley Security Solutions

F. Door Closers shall:

1. Tested and approved by BHMA for ANSI 156.4, Grade 1
2. UL10C certified
3. Provide 9001-Quality Management and 14001-Environmental Management.
4. Closer shall have extra-duty arms and knuckles
5. Conform to ANSI 117.1
6. Maximum 2 7/16 inch case projection with non-ferrous cover
7. Separate adjusting valves for closing and latching speed, and backcheck
8. Provide adapter plates, shim spacers and blade stop spacers as required by frame and door conditions
9. Full rack and pinion type closer with 1 1/2" minimum bore
10. Mount closers on non-public side of door, unless otherwise noted in specification
11. Closers shall be non-handed, non-sized and multi-sized.

G. Door Stops: Provide a dome floor or wall stop for every opening as listed in the hardware sets.

1. Wall stop and floor stop shall be wrought bronze, brass or stainless steel.
2. Provide fastener suitable for wall construction.

3. Coordinate reinforcement of walls where wall stop is specified.
 4. Provide dome stops where wall stops are not practical. Provide spacers or carpet riser for floor conditions encountered
- H. Over Head Stops: Provide a concealed overhead when a floor or wall stop cannot be used or when listed in the hardware set.
1. Concealed overhead stops shall be heavy duty bronze or stainless steel.
- I. Push Pull Bars: Provide ANSI J504, .1" Dia. Pull and push bar model and series as listed in hardware set. Provide proper fasteners for door construction.
- J. Kickplates: Provide with four beveled edges ANSI J102, 10 inches high by width less 2 inches on single doors and 1 inch on pairs of doors. Furnish oval-head countersunk screws to match finish.
- K. Door Bolts: Flush bolts for wood or metal doors.
1. Provide a set of Automatic bolts, Certified ANSI/BHMA 156.3 Type 27 at wood label doors.
 2. Manual flush bolts, Certified ANSI/BHMA 156.16 at openings where allowed local authority.
- L. Coordinator and Brackets: Provide a surface mounted coordinator when automatic bolts are used in the hardware set.
1. Coordinator, Certified ANSI/BHMA A1156.3 Type 21A for full width of the opening.
 2. Provide mounting brackets for soffit applied hardware.
 3. Provide hardware preparation (cutouts) for latches as necessary.
- M. Electric Door Strike: Certified by ANSI/BHMA 156.31, Grade 1. and listed for Burglary Protection ANSI/ UL1034 Grade 1.
1. For General use provide fail-secure electric strike and with fire-rated device.
 2. Listed UL10C for Fire Door assemblies
 3. Latchbolt monitor switch option when specified in hardware sets.
 4. Provide the electric strike in the appropriate model that will accept a 5/8" or 3/4" latchbolt.
- N. Magnetic Door Holders: Provide magnetic door holders with Tri-Voltage that can be wired 12VDC, 24V AC/DC or 120V AC
1. Wall magnetic door holders shall be **[Recessed, Surface or Flush mounted]**.
 2. Armature shall be thru-bolted and can be provided with any projection required.
 3. Models will be available in US28, sprayed finishes and US32D.
 4. Floor mounted shall be provided for a single door or double door hold open application.
- O. Seals: All seals shall be finished to match adjacent frame color. Seals shall be furnished as listed in schedule. Material shall be UL listed for labeled openings.
- P. Weatherstripping: Provide at head and jambs only those units where resilient or flexible seal strip is easily replaceable. Where bar-type weatherstrip is used with parallel arm mounted closers install weatherstrip first.

1. Weatherstrip shall be resilient seal of (Neoprene, Polyurethane, Vinyl, Pile, Nylon Brush, Silicone)
 2. UL10C Positive Pressure rated seal set when required.
- Q. Door Bottoms/Sweeps: Surface mounted or concealed door bottom where listed in the hardware sets.
1. Door seal shall be resilient seal of (Neoprene, Polyurethane, Nylon Brush, Silicone)
 2. UL10C Positive Pressure rated seal set when required.
- R. Thresholds: Thresholds shall be aluminum beveled type with maximum height of ½" for conformance with ADA requirements. Furnish as specified and per details. Provide fasteners and screws suitable for floor conditions.
- S. Silencers: Furnish silencers on all interior frames, 3 for single doors, 2 for pairs. Omit where any type of seals occur.
- 1.11 FINISH:
- A. Designations used in Schedule of Finish Hardware - 3.05, and elsewhere to indicate hardware finishes are those listed in ANSI/BHMA A156.18 including coordination with traditional U.S. finishes shown by certain manufacturers for their products
 - B. Powder coat door closers to match other hardware, unless otherwise noted.
 - C. Aluminum items shall be finished to match predominant adjacent material. Seals to coordinate with frame color.
- 1.12 KEYS AND KEYING:
- A. Provide keyed brass construction cores and keys during the construction period. Construction control and operating keys and core shall not be part of the Owner's permanent keying system or furnished in the same keyway (or key section) as the Owner's permanent keying system. Permanent cores and keys (prepared according to the accepted keying schedule) will be furnished to the Owner.
 - B. Cylinders, removable and interchangeable core system: Best CORMAX™ Patented 7-pin.
 - C. Permanent keys and cores: Stamped with the applicable key mark for identification. These visual key control marks or codes will not include the actual key cuts. Permanent keys will also be stamped "Do Not Duplicate."
 - D. Transmit Grand Masterkeys, Masterkeys and other Security keys to Owner by Registered Mail, return receipt requested.
 - E. Furnish keys in the following quantities:
 1. 1 each Grand Masterkeys
 2. 4 each Masterkeys
 3. 2 each Change keys each keyed core
 4. 15 each Construction masterkeys
 5. 1 each Control keys

- F. The Owner, or the Owner's agent, will install permanent cores and return the construction cores to the Hardware Supplier. Construction cores and keys remain the property of the Hardware Supplier.
- G. Keying Schedule: Arrange for a keying meeting, and programming meeting with Architect Owner and hardware supplier, and other involved parties to ensure locksets and locking hardware, are functionally correct and keying and programming complies with project requirements. Furnish 3 typed copies of keying and programming schedule to Architect.

PART 2 - EXECUTION

2.1 EXAMINATION

- A. Verification of conditions: Examine doors, frames, related items and conditions under which Work is to be performed and identify conditions detrimental to proper and or timely completion.
 - 1. Do not proceed until unsatisfactory conditions have been corrected.

2.2 HARDWARE LOCATIONS:

- A. Mount hardware units at heights indicated in the following publications except as specifically indicated or required to comply with the governing regulations.
 - 1. Recommended Locations for Builder's Hardware for Standard Steel Doors and Frames, by the Door and Hardware Institute (DHI).
 - 2. Recommended locations for Architectural Hardware for flush wood doors (DHI).
 - 3. WDMA Industry Standard I.S.-1A-04, Industry Standard for Architectural wood flush doors.

2.3 INSTALLATION:

- A. Install each hardware item per manufacturer's instructions and recommendations. Do not install surface mounted items until finishes have been completed on the substrate. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
- B. Conform to local governing agency security ordinance.
- C. Install Conforming to ICC/ANSI A117.1 Accessible and Usable Building and Facilities.
 - 1. Adjust door closer sweep periods so that from the 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 landing side of the door.
- D. Installed hardware using the manufacturers fasteners provided. Drill and tap all screw holes located in metallic materials. Do not use "Riv-Nuts" or similar products.

2.4 FIELD QUALITY CONTROL AND FINAL ADJUSTMENT

- A. Contractor/Installers, Field Services: After installation is complete, contractor shall inspect the completed door openings on site to verify installation of hardware is complete and properly adjusted, in accordance with both the Contract Documents and final shop drawings.

1. Check and adjust closers to ensure proper operation.
2. Check latchset, lockset, and exit devices are properly installed and adjusted to ensure proper operation.
 - a. Verify levers are free from binding.
 - b. Ensure latchbolts and dead bolts are engaged into strike and hardware is functioning.
3. Report findings, in writing, to architect indicating that all hardware is installed and functioning properly. Include recommendations outlining corrective actions for improperly functioning hardware if required.

2.5 SCHEDULE OF FINISH HARDWARE:

Option List

<u>Code</u>	<u>Description</u>
S	Slim Cover
BF	Barrier Free
FL	Fire Exit Hardware
MLR	MOTORIZED LATCH RETRACTION

Finish List

<u>Code</u>	<u>Description</u>
AL	Aluminum
BC	Black Chrome
26D	Satin Chrome
625	Bright Chromium Plated
626	Satin Chromium Plated
630	Satin Stainless Steel
689	Aluminum Painted
695	Dark Bronze Painted
BLACK	Black
US26D	Chromium Plated, Dull
US32D	Stainless Steel, Dull

Manufacturer List

<u>Code</u>	<u>Name</u>
AB	ABH Manufacturing Inc.
ALTR	Altronix
HS	HES
NA	National Guard
ONIT	Onity
PE	Pemko

PR	Precision
SH	Stanley Commercial Hardware
ST	Stanley
TESA	Tesa Locks
TR	Trimco

Hardware Sets

SET #1

3 Hinges	FBB179 4 1/2 X 4 1/2	US26D	ST
1 Advanced Card Lock	KRF3-M-B Wing	626	ONIT
1 Door Closer (Cush)	QDC313 BF S	689	SH
1 Security Door Guard	SDG	26D	NA
1 Door Viewer	976U	625	TR
1 Smoke Seal	5075B Head and Jamb		NA
1 Door Bottom	2173 AV 36"		PE
1 Carpet Divider	402 36"		NA

NOTE: Note: 2 viewers @ ADA Units, Un Notched Door Bottom @ Smoking Units

SET #2

1 Pocket Door Pull	1065	626	TR
1 Pocket Door Set	PDFC150N-00-68		ST

SET #3

1 Hinges	FBB179 4 1/2 X 4 1/2	US26D	ST
2 Spring Hinges	2060R 4 1/2 X 4 1/2	US32D	ST
1 Deadlock	QDB282	626	SH
1 Communicating Set	QCL235 A	626	SH
1 Wall Bumper	1270WV	630	TR
1 Security Door Guard	SDG	26D	NA
1 Smoke Seal	5075B Head and Jamb		NA
1 Door Bottom	2173 AV UN 36"		PE
1 Carpet/Tile Divider	402 x 400 x 402		NA

NOTE: Note: Carpet/Tile Divider only 1 per Opening

SET #4

3 Hinges	F179 4 1/2 X 4 1/2	US26D	ST
1 Privacy Set	QCL240 A	626	SH
1 Roller Stop	1245	626	TR

SET #5

3 Hinges	F179 4 1/2 X 4 1/2	US26D	ST
1 Privacy Set	QCL240 A	626	SH
1 Wall Bumper	1270WV	630	TR

SET #6

1 Push Button	VZ400880	695	ONIT
1 Access Sliding Door Kit	KHA3-SLD	626	ONIT

NOTE: Balance of Hardware by Door MFG.

SET #7

1	Continuous Hinge	662 UL	AL	ST
1	Advanced Card Lock	KRF3-M-B Wing	626	ONIT
1	Door Closer	QDC211 BF S	689	SH
1	Wall Bumper	1270WV	630	TR

SET #8

2	Continuous Hinge	662 UL	AL	ST
1	Exit Device	MLR 2603 x 8'6"	630	PR
1	Exit Device	2601 x 8'6"	630	PR
1	Rim Cylinder	6EQR 6LA2	626	SH
2	Door Pull	1191-5	630	TR
2	Door Closer	QDC115	689	SH
2	Overhead Stop	1020 Series	US32D	AB
1	Power Supply	DPS1ULT w/Battery Backup		ALTR
1	Power Supply for Exit Device	RPSMLR2		PR
1	Card Reader	Remote RFID Reader	626	TESA
1	Handicap Threshold	513 1/4-20 MS/LA	AL	NA

NOTE: Weatherstrip and Door Sweeps by Door MFG.

SET #9

1	Continuous Hinge	662 UL	AL	ST
1	Exit Device	2403	630	PR
1	Rim Cylinder	6EQR 6LA2	626	SH
1	Electric Strike Body	9600	630	HS
1	Door Pull	1191-5	630	TR
1	Door Closer	QDC211 BF S	689	SH
1	Wall Bumper	1270WV	630	TR
1	Power Supply	DPS1ULT w/Battery Backup		ALTR
1	Card Reader	Remote RFID Reader	626	TESA

SET #10

NOTE: All hardware by door MFG

SET #11

3	Hinges	FBB179 4 1/2 X 4 1/2	US26D	ST
1	Lockset	QCL170 A	626	SH
1	Door Closer	QDC211 BF S	689	SH
1	Wall Bumper	1270WV	630	TR
1	Gasketing	5050 B Head & Jambs		NA
1	Handicap Threshold	513 1/4-20 MS/LA	AL	NA

SET #12

1	Continuous Hinge	662 UL	AL	ST
1	Exit Device	2403	630	PR
1	Rim Cylinder	6EQR 6LA2	626	SH
1	Electric Strike Body	9600	630	HS
1	Door Pull	1191-5	630	TR
1	Door Closer	QDC115	689	SH
1	Floor Stop	1201	626	TR

**Home 2 Suites
Helena, Montana**

**DOOR HARDWARE
SECTION 08 71 00**

1 Card Reader	Remote RFID Reader	626	TESA
1 Handicap Threshold	513 1/4-20 MS/LA	AL	NA

NOTE: Weatherstrip & Door Sweeps by Door MFG

SET #13

6 Hinges	FBF191 4 1/2 X 4 1/2	US32D	ST
2 Flush Bolt	3917-12	626	TR
1 Lockset	QCL170 A	626	SH
2 Door Closer	QDC211 BF S	689	SH
1 Gasketing	127 SA Head & Jambs		NA

SET #14

3 Hinges	FBF179 4 1/2 X 4 1/2	US26D	ST
1 Privacy Set	QCL140 A	626	SH
1 Door Closer	QDC211 BF S	689	SH
1 Wall Bumper	1270WV	630	TR
1 Gasketing	127 SA Head & Jambs		NA
1 Door Sweep	200 NA		NA
1 Handicap Threshold	513 1/4-20 MS/LA	AL	NA

SET #15

3 Hinges	FBF179 4 1/2 X 4 1/2	US26D	ST
1 Exit Device	FL2114 X 4914B	630	PR
1 Door Closer	QDC211 BF S	689	SH
1 Wall Bumper	1270WV	630	TR
1 Gasketing	5050 B Head & Jambs		NA

SET #16

3 Hinges	FBF191 4 1/2 X 4 1/2 NRP	US32D	ST
1 Exit Device	FL 2103 X 4903B	630	PR
1 Rim Cylinder	6EQR 6LA2	626	SH
1 Electric Strike Body	9600	630	HS
1 Door Closer	QDC115	689	SH
1 Floor Stop	1201	626	TR
1 Card Reader	Remote RFID Reader	626	TESA
1 Gasketing	127 SA Head & Jambs		NA
1 Door Sweep	200 NA		NA
1 Handicap Threshold	513 1/4-20 MS/LA	AL	NA

SET #17

3 Hinges	FBF179 4 1/2 X 4 1/2	US26D	ST
1 Advanced Card Lock	KRF3-M-B Wing	626	ONIT
1 Door Closer	QDC211 BF S	689	SH
1 Wall Bumper	1270WV	630	TR
1 Gasketing	5050 B Head & Jambs		NA

SET #18

3 Hinges	FBF179 4 1/2 X 4 1/2	US26D	ST
1 Lockset	QCL250 A	626	SH
1 Floor Stop	1211	626	TR

SET #19

4 Hinges	FBF179 4 1/2 X 4 1/2	US26D	ST

**Home 2 Suites
Helena, Montana**

**DOOR HARDWARE
SECTION 08 71 00**

1	Advanced Card Lock	KRF3-M-B Wing	626	ONIT
1	Door Closer	QDC111 BF	689	SH
1	Wall Bumper	1270WV	630	TR
1	Gasketing	5050 B Head & Jambs		NA

SET #1A

3	Hinges	FBF179 4 1/2 X 4 1/2	US26D	ST
1	Advanced Card Lock	KRF3-M-B Wing	626	ONIT
1	Door Closer	QDC211 BF S	689	SH
1	Wall Bumper	1270WV	630	TR
1	Door Viewer	976U	625	TR
1	Smoke Seal	5075B Head and Jamb		NA
1	Door Bottom	2173 AV 36"		PE
1	Carpet Divider	402 36"		NA

NOTE: Mount Viewer to look into Meeting Rooms, Lock to be Office Function

SET #20

3	Hinges	FBF179 4 1/2 X 4 1/2	US26D	ST
1	Advanced Card Lock	KRF3-M-B Wing	626	ONIT
1	Door Closer	QDC211 BF S	689	SH
1	Wall Bumper	1270WV	630	TR
1	Gasketing	5050 B Head & Jambs		NA

SET #21

3	Hinges	FBF179 4 1/2 X 4 1/2	US26D	ST
1	Privacy Set	QCL240 A	626	SH
1	Door Closer	QDC211 BF S	689	SH
1	Kick Plate	K0050 10" x 2" LDW	630	TR
1	Wall Bumper	1270WV	630	TR
1	Gasketing	5050 B Head & Jambs		NA

SET #22

3	Hinges	FBF179 4 1/2 X 4 1/2	US26D	ST
1	Exit Device	FL2114 X 4914B	630	PR
1	Magnetic Holder	2100	US32D	AB
1	Door Closer	QDC211 BF S	689	SH
1	Gasketing	5050 B Head & Jambs		NA

SET #23

8	Hinges	FBF168 4 1/2 X 4 1/2	US26D	ST
2	Set Auto Flush Bolts	3815L X 3850	630	TR
1	Passage Set	QCL130 A	626	SH
2	Magnetic Holder	2100	US32D	AB
1	Coordinator	3094C4	BLACK	TR
2	Gasketing	5050 B Head & Jambs		NA
1	Astragal	139 SP x 5050 B		NA

SET #24

4	Hinges	FBF168 4 1/2 X 4 1/2	US26D	ST
1	Advanced Card Lock	KRF3-M-B Wing	626	ONIT
1	Door Closer	QDC211 BF S	689	SH
1	Wall Bumper	1270WV	630	TR
1	Gasketing	5050 B Head & Jambs		NA

SET #25

3 Hinges	FBF168 4 1/2 X 4 1/2	US26D	ST
1 Passage Set	QCL130 A	626	SH
1 Magnetic Holder	2100	US32D	AB
1 Door Closer	QDC211 BF S	689	SH
1 Gasketing	5050 B Head & Jambs		NA

SET #26

3 Hinges	FBF179 4 1/2 X 4 1/2	US26D	ST
1 Lockset	QCL170 A	626	SH
1 Wall Bumper	1270WV	630	TR

SET #27

3 Hinges	FBF191 4 1/2 X 4 1/2 NRP	US32D	ST
1 Advanced Card Lock	KRF3-M-B Wing	626	ONIT
1 Door Closer	QDC115	689	SH
1 Floor Stop	1201	626	TR
1 Gasketing	127 SA Head & Jambs		NA
1 Drip Cap	16 A - 4" ODW		NA
1 Door Sweep	200 NA		NA
1 Handicap Threshold	513 1/4-20 MS/LA	AL	NA

SET #2A

1 Sliding Door Pull	1069L	630	TR
1 Pocket Door Set	PDFC150N-00-68		ST

SET #14A

3 Hinges	FBF179 4 1/2 X 4 1/2	US26D	ST
1 Lockset	QCL170 A	626	SH
1 Door Closer	QDC211 BF S	689	SH
1 Wall Bumper	1270WV	630	TR
1 Gasketing	5050 B Head & Jambs		NA

SET #18A

2 Continuous Hinge	662 UL	AL	ST
1 Dummy Bar	N673DR-3	630	PR
2 Door Pull	1191-5	630	TR
2 Door Closer	QDC115	689	SH
2 Overhead Stop	1020 Series	US32D	AB

SET #MISC

3 Key200pk,MiFare, UL	DMU10001	626	TESA
15 Const. Cards	DM100001	626	TESA
1 Onity Front Desk Encoder	KHF-HT22P		TESA
1 HT22P Encoder RFID Add	KHF-HT22P-ADD		TESA
100 RFID Cards	DMU00001		TESA
4 Wall Reader Power Supply	KHA3-WRPS-3-B	BC	TESA

Opening List

<u>Opening</u>	<u>Hdw Set</u>
GR1	1
GR2	2
GR3	3
GR4	5
GR5	4
GR6	2A
X34	23
X35	24
X51	15
X52	15
001A	10
001B	6
002A	8
002B	18A
007A	17
007B	17
009	26
010	18
011	9
012A	19
012B	25
013	20
014	26
015A	12
015B	12
016	13
016A	13
016B	14
017	21
018	11
019A	14
01A	6
02A	8
020	21
021	21
022	14A
023	17
023A	14A
023B	14A
024	7
025	14A
026A	17
026B	27
027	18
028	18
051	15
051A	16
052	15

**Home 2 Suites
Helena, Montana**

**DOOR HARDWARE
SECTION 08 71 00**

052A	16
113	1A
113A	14A
115	1A
115A	17
115B	14A
115C	1A
133A	22
133B	12
MISC	MISC

SECTION 08 8000

GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Insulating glass units.
- B. Glazing units.
- C. Glazing compounds and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 07 2500 - Weather Barriers.
- B. Section 07 9200 - Joint Sealants: Sealants for other than glazing purposes.
- C. Section 08 1113 - Hollow Metal Doors and Frames: Glazed lites in doors and borrowed lites.
- D. Section 08 1416 - Flush Wood Doors: Glazed lites in doors.
- E. Section 08 4229 - Automatic Entrances: Glazing furnished as part of door assembly.
- F. Section 08 4313 - Aluminum-Framed Storefronts: Glazing furnished as part of storefront assembly.
- G. Section 08 5113 - Aluminum Windows: Glazing furnished by window manufacturer.

1.03 REFERENCE STANDARDS

- A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; current edition.
- B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings, Safety Performance Specifications and Methods of Test; 2010.
- C. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2011).
- D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014.
- E. ASTM C1036 - Standard Specification for Flat Glass; 2011e1.
- F. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2012.
- G. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016.
- H. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass; 2015.
- I. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings; 2012a.
- J. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation; 2010.
- K. GANA (GM) - GANA Glazing Manual; Glass Association of North America; 2009.
- L. GANA (SM) - GANA Sealant Manual; Glass Association of North America; 2008.
- M. ICC (IBC) - International Building Code; 2015.
- N. NFRC 100 - Procedure for Determining Fenestration Product U-factors; 2014.
- O. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence; 2014.
- P. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems; 2014.

1.04 SUBMITTALS

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

- B. Product Data on Insulating Glass Unit and Glazing Unit Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.
- C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colors.
- D. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Perform Work in accordance with GANA glazing manual and FGMA sealant manual for glazing installation methods. Maintain one copy on site.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum 5 years of documented experience.
- C. Installer Qualifications: Company specializing in performing work of the type specified and with at least 5 years documented experience.

1.06 FIELD CONDITIONS

- A. Do not install glazing when ambient temperature is less than 40 degrees F (4 degrees C).
- B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.07 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Insulating Glass Units: Provide a five (5) year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including replacement of failed units.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS - EXTERIOR GLAZING ASSEMBLIES

- A. Select type and thickness of exterior glazing assemblies to withstand dead and live loads caused by positive and negative wind pressure acting normal to plane of glass.
 - 1. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
 - 2. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.
 - 3. Glass thicknesses listed are minimum.
- B. Vapor Retarder and Air Barrier Seals: Provide completed assemblies that maintain continuity of building enclosure vapor retarder and air barrier.
 - 1. In conjunction with vapor retarder and joint sealer materials described in other sections.
- C. Thermal and Optical Performance: Provide glass products with performance properties as indicated. Performance properties are in accordance with manufacturer's published data as determined with the following procedures and/or test methods:
 - 1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 5.2/6.3 computer program.
 - 2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 5.2/6.3 computer program.
 - 3. Solar Optical Properties: Comply with NFRC 300 test method.

2.02 GLASS MATERIALS

- A. Float Glass: Provide float glass based glazing unless noted otherwise.
 - 1. Annealed Type: ASTM C1036, Type I - Transparent Flat, Class 1 - Clear, Quality-Q3.
 - 2. Heat-Strengthened and Fully Tempered Types: ASTM C1048, Kind HS and FT.
 - 3. Fully Tempered Safety Glass: Complies with ANSI Z97.1 and 16 CFR 1201 criteria.

4. Thicknesses: As indicated; provide greater thickness as required for exterior glazing wind load design.

2.03 INSULATING GLASS UNITS

- A. Insulating Glass Units: Types as indicated.
 1. Durability: Certified by an independent testing agency to comply with ASTM E2190.
 2. Coated Glass: Comply with requirements of ASTM C1376 for pyrolytic (hard-coat) or magnetic sputter vapor deposition (soft-coat) type coatings on flat glass; coated vision glass, Kind CV; coated overhead glass, Kind CO; or coated spandrel glass, Kind CS.
 3. Warm-Edge Spacers: Polypropylene and stainless steel.
 - a. Spacer Width: As required for specified insulating glass unit.
 4. Spacer Color: Black.
 5. Edge Seal:
 - a. Dual-Sealed System: Provide polyisobutylene sealant as primary seal applied between spacer and glass panes, and silicone, polysulfide, or polyurethane sealant as secondary seal applied around perimeter.
 6. Color: Black.
 7. Purge interpane space with dry air, hermetically sealed.
 8. Capillary Tubes: Provide tubes from air space for insulating glass units without inert type gas that have a change of altitude greater than 2500 feet (762 m) between point of fabrication and point of installation to permit pressure equalization of air space.
 - a. Capillary Tubes: Tubes to remain open and be of length and material type in accordance with insulating glass fabricator's requirements.
- B. Type IG-1 - Insulating Glass Units: Vision glass, double glazed.
 1. Applications: Exterior glazing unless otherwise indicated.
 2. Space between lites filled with air.
 3. Outboard Lite: Annealed float glass, 1/4 inch (6.4 mm) thick, minimum.
 - a. Tint: Clear.
 4. Inboard Lite: Annealed float glass, 1/4 inch (6.4 mm) thick, minimum.
 - a. Tint: Clear.
 - b. Coating: Low-E, on #3 surface.
 5. Total Thickness: 1 inch (25.4 mm).
 6. Thermal Transmittance (U-Value): 0.35, nominal.
 7. Solar Heat Gain Coefficient (SHGC): 0.33, nominal.
- C. Type IG-5 - Insulating Glass Units: Safety glazing.
 1. Applications:
 - a. Glazed lites in exterior doors.
 - b. Glazed sidelights and panels next to doors.
 - c. Other locations required by applicable federal, state, and local codes and regulations.
 2. Space between lites filled with air.
 3. Glass Type: Same as Type IG-1 except use fully tempered float glass for both outboard and inboard lites.
 4. Total Thickness: 1 inch (25.4 mm).
 5. Thermal Transmittance (U-Value): 0.35, nominal.
 6. Solar Heat Gain Coefficient (SHGC): 0.33, nominal.

2.04 GLAZING UNITS

- A. Type G-2 - Monolithic Interior Vision Glazing:
 1. Applications: Interior glazing unless otherwise indicated.
 2. Glass Type: Annealed float glass.
 3. Tint: Clear.
 4. Thickness: 1/4 inch (6.4 mm), nominal.
- B. Type G-3 - Fire-Resistance-Rated Glazing: Type, thickness, and configuration as required to achieve indicated ratings.

1. Applications:
 - a. Glazed lites in fire doors.
 - b. Sidelights, borrowed lites, and other glazed openings in partitions indicated as having an hourly fire rating.
 2. Labeling: Provide permanent label on fire-rated glazing in compliance with ICC (IBC) and authorities having jurisdiction.
 3. Provide products listed by Underwriters Laboratories or Intertek Warnock Hersey.
 4. Safety Glazing Certification: 16 CFR 1201 Category II.
 5. Fire-Resistance-Rating Period: As indicated on drawings.
- C. Type G-5 - Monolithic Safety Glazing: Non-fire-rated.
1. Applications:
 - a. Glazed lites in doors, except fire doors.
 - b. Glazed sidelights to doors, except in fire-rated walls and partitions.
 - c. Other locations required by applicable federal, state, and local codes and regulations.
 - d. Other locations indicated on the drawings.
 2. Glass Type: Fully tempered safety glass as specified.
 3. Tint: Clear.
 4. Thickness: 1/4 inch (6.4 mm), nominal.

2.05 GLAZING COMPOUNDS

- A. Manufacturers:
1. Bostik Inc; _____: www.bostik-us.com.
 2. Momentive Performance Materials, Inc (formerly GE Silicones); _____: www.momentive.com.
 3. Pecora Corporation; _____: www.pecora.com.
 4. BASF Corporation; _____: www.basf.com/us/en.html.
 5. Substitutions: Refer to Section 01 6000 - Product Requirements.
- B. Type GC-3 - Polysulfide Sealant: Two component; chemical curing, non-sagging type; ASTM C920, Type M, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 15 to 25; color as selected.

2.06 ACCESSORIES

- A. Setting Blocks: Neoprene, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot (25 mm for each square meter) of glazing or minimum 4 inch (100 mm) x width of glazing rabbet space minus 1/16 inch (1.5 mm) x height to suit glazing method and pane weight and area.
- B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness; ASTM C864 Option II. Minimum 3 inch (75 mm) long x one half the height of the glazing stop x thickness to suit application, self adhesive on one face.
- C. Glazing Tape, Back Bedding Mastic Type: Preformed, butyl-based, 100 percent solids compound with integral resilient spacer rod applicable to application indicated; 5 to 30 cured Shore A durometer hardness; coiled on release paper; black color.
1. Width: As required for application.
 2. Thickness: As required for application.
- D. Glazing Gaskets: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; color black.
- E. Glazing Clips: Manufacturer's standard type.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

- A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.

- B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.

3.02 PREPARATION

- A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.
- B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.03 INSTALLATION, GENERAL

- A. Install glazing sealants in accordance with ASTM C1193, GANA Sealant Manual, and manufacturer's instructions.

3.04 CLEANING

- A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.
- B. Remove non-permanent labels immediately after glazing installation is complete.
- C. Clean glass and adjacent surfaces after sealants are fully cured.
- D. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

3.05 PROTECTION

- A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.
- B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

END OF SECTION

SECTION 09 2116
GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Metal stud wall framing.
- B. Metal channel ceiling framing.
- C. Cementitious backing board.
- D. Gypsum wallboard.
- E. Joint treatment and accessories.
- F. Textured finish system.

1.02 RELATED REQUIREMENTS

- A. Section 06 1000 - Rough Carpentry: Building framing.
- B. Section 06 1000 - Rough Carpentry: Wood blocking product and execution requirements.
- C. Section 07 2100 - Thermal Insulation: Acoustic insulation.
- D. Section 07 8400 - Firestopping: Top-of-wall assemblies at fire rated walls.
- E. Section 07 9200 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.
- F. Section 09 3000 - Tiling: Tile backing board.

1.03 REFERENCE STANDARDS

- A. ANSI A108.11 - American National Standard for Interior Installation of Cementitious Backer Units; 2010 (Revised).
- B. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units; 1999 (Reaffirmed 2010).
- C. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2015.
- D. ASTM C514 - Standard Specification for Nails for the Application of Gypsum Board; 2004 (Reapproved 2014).
- E. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members; 2014.
- F. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2015.
- G. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2013.
- H. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2015.
- I. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2014.
- J. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base; 2014a.
- K. ASTM C1325 - Standard Specification for Non-Asbestos Fiber-Mat Reinforced Cement Substrate Sheets; 2014.
- L. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2014.
- M. GA-216 - Application and Finishing of Gypsum Board; Gypsum Association; 2013.
- N. GA-600 - Fire Resistance Design Manual; Gypsum Association; 2015.
- O. ICC (IBC) - International Building Code; 2015.
- P. UL (FRD) - Fire Resistance Directory; Underwriters Laboratories Inc.; current edition.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate special details associated with fireproofing and acoustic seals.
- C. Product Data: Provide data on metal framing, gypsum board, accessories, and joint finishing system.
- D. Test Reports: For stud framing products that do not comply with ASTM C645 or ASTM C754, provide independent laboratory reports showing maximum stud heights at required spacings and deflections.
- E. Samples: Submit two samples of gypsum board finished with proposed texture application, 12 by 12 inches (300 by 300 mm) in size, illustrating finish color and texture.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing gypsum board application and finishing, with minimum three years of documented experience.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

- A. Provide completed assemblies complying with ASTM C840 and GA-216.

2.02 METAL FRAMING MATERIALS

- A. Non-Loadbearing Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/240 at 5 psf (L/240 at 240 Pa).
 - 1. Studs: "C" shaped with flat or formed webs with knurled faces.
 - 2. Runners: U shaped, sized to match studs.
 - 3. Ceiling Channels: T-shaped.
 - 4. Furring: Hat-shaped sections, minimum depth of 7/8 inch (22 mm).
 - 5. Resilient Furring Channels: 1/2 inch (12 mm) depth, for attachment to substrate through one leg only.
- B. Shaft Wall Studs and Accessories: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 and specified performance requirements.
- C. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.

2.03 BOARD MATERIALS

- A. Manufacturers - Gypsum-Based Board:
 - 1. American Gypsum Company; ____: www.americangypsum.com.
 - 2. CertainTeed Corporation; ____: www.certainteed.com.
 - 3. Georgia-Pacific Gypsum; ____: www.gpgypsum.com.
 - 4. National Gypsum Company; ____: www.nationalgypsum.com.
 - 5. USG Corporation; ____: www.usg.com.
 - 6. Substitutions: See Section 01 6000 - Product Requirements.
- B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
 - 1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
 - 2. At Assemblies Indicated with Fire-Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
 - 3. Thickness:
 - a. Vertical Surfaces: 5/8 inch (16 mm).
 - b. Ceilings: 5/8 inch (16 mm).
 - c. Multi-Layer Assemblies: Thicknesses as indicated on drawings.
- C. Backing Board For Wet Areas:
 - 1. Application: Surfaces behind tile in wet areas including tub and shower surrounds, shower ceilings, and wall behind janitor sinks.

2. ANSI Cement-Based Board: Non-gypsum-based; aggregated Portland cement panels with glass fiber mesh embedded in front and back surfaces complying with ANSI A118.9 or ASTM C1325.
 - a. Thickness: 1/2 inch (12.7 mm).
 - b. Products:
 - 1) National Gypsum Company; PermaBase Cement Board: www.nationalgypsum.com.
 - 2) USG Corporation; Durock Brand Cement Board: www.usg.com.
 - 3) National Gypsum Company; PermaBase Flex Brand Cement Board..
 - 4) Substitutions: See Section 01 6000 - Product Requirements.
- D. Backing Board For Non-Wet Areas: Water-resistant gypsum backing board as defined in ASTM C1396/C1396M; sizes to minimum joints in place; ends square cut.
 1. Application: Vertical surfaces behind thinset tile, except in wet areas.
 2. Type: Regular and Type X, in locations indicated.
 3. Type X Thickness: 5/8 inch (16 mm) or as indicated on drawings.
 4. Regular Board Thickness: 5/8 inch (16 mm).
 5. Edges: Tapered.
 6. Products:
 - a. American Gypsum Company; M-Bloc.
 - b. American Gypsum Company; M-Bloc Type X.
 - c. Georgia-Pacific Gypsum; ToughRock Mold-Guard Gypsum Board.
 - d. Georgia-Pacific Gypsum; DensArmor Plus.
 - e. National Gypsum Company; Gold Bond XP Gypsum Board.
 - f. Substitutions: See Section 01 6000 - Product Requirements.
- E. Shaftwall and Coreboard: Type X; 1 inch (25 mm) thick (or as indicated on drawings) by 24 inches (610 mm) wide, beveled long edges, ends square cut.
 1. Products:
 - a. American Gypsum Company; M-Glass Shaft Liner.
 - b. American Gypsum Company; M-Bloc Shaft Liner.
 - c. American Gypsum Company; Shaft Liner.
 - d. Georgia-Pacific Gypsum; DensGlass Shaftliner (mold-resistant).
 - e. Georgia-Pacific Gypsum; ToughRock Shaftliner.
 - f. National Gypsum Company; Gold Bond Brand eXP Shaftliner.
 - g. National Gypsum Company; Gold Bond Fire-Shield Shaftliner XP.
 - h. Substitutions: See Section 01 6000 - Product Requirements.

2.04 ACCESSORIES

- A. Acoustic Insulation: As specified in Section 07 2100.
- B. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.
 1. Products:
 - a. Franklin International, Inc.; Titebond GREENchoice Professional Acoustical Smoke and Sound Sealant: www.titebond.com/sle.
 - b. Substitutions: See Section 01 6000 - Product Requirements.
- C. Finishing Accessories: ASTM C1047, galvanized steel or rolled zinc, unless noted otherwise.
 1. Types: As detailed or required for finished appearance.
 2. Special Shapes: In addition to conventional corner bead and control joints, provide U-bead and LC-bead at exposed panel edges. Provide 5/8" deep x 3/8" wide V-reveals at ceilings as indicated on drawings.
 3. Products:
 - a. Phillips Manufacturing Co: www.phillipsmfg.com.
 - b. Trim-tex, Inc.: www.trim-tex.com.
 - c. Flannery, Inc.: <http://flannerytrim.com>.
 - d. Substitutions: See Section 01 6000 - Product Requirements.

- D. Joint Materials: ASTM C475 and as recommended by gypsum board manufacturer for project conditions.
 - 1. Tape: 2 inch (50 mm) wide, coated glass fiber tape for joints and corners, except as otherwise indicated.
 - 2. Tape: 2 inch (50 mm) wide, creased paper tape for joints and corners, except as otherwise indicated.
 - 3. Ready-mixed vinyl-based joint compound.
- E. High Build Drywall Surfer: Vinyl acrylic latex-based coating for spray application, designed to take the place of skim coating and separate paint primer in achieving Level 5 finish.
- F. Textured Finish Materials: Latex-based compound; plain.
- G. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inch (0.84 mm) in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion resistant.
- H. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch (0.84 to 2.84 mm) in Thickness: ASTM C954; steel drill screws, corrosion resistant.
- I. Screws for Attachment to Wood Members: ASTM C514.
- J. Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that project conditions are appropriate for work of this section to commence.

3.02 SHAFT WALL INSTALLATION

- A. Shaft Wall Framing: Install in accordance with manufacturer's installation instructions.
- B. Shaft Wall Liner: Cut panels to accurate dimension and install sequentially between special friction studs.

3.03 FRAMING INSTALLATION

- A. Metal Framing: Install in accordance with ASTM C754 and manufacturer's instructions.
- B. Suspended Ceilings and Soffits: Space framing and furring members as indicated.
 - 1. Level ceiling system to a tolerance of 1/1200.
 - 2. Laterally brace entire suspension system.
- C. Studs: Space studs as indicated.
 - 1. Extend partition framing to structure in all locations.
- D. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.
- E. Acoustic Furring: Install resilient channels at maximum 24 inches (600 mm) on center. Locate joints over framing members.
- F. Furring for Fire Ratings: Install as required for fire resistance ratings indicated and to GA-600 requirements.
- G. Blocking: Install wood blocking for support of:
 - 1. Framed openings.
 - 2. Wall mounted cabinets.
 - 3. Plumbing fixtures.
 - 4. Toilet accessories.
 - 5. Wall mounted door hardware.

3.04 ACOUSTIC ACCESSORIES INSTALLATION

- A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.

- B. Acoustic Sealant: Install in accordance with manufacturer's instructions.
 - 1. Place one bead continuously on substrate before installation of perimeter framing members.
 - 2. Place continuous bead at perimeter of each layer of gypsum board.
 - 3. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes, except where firestopping is provided.

3.05 BOARD INSTALLATION

- A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.
- B. Fire-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.
- C. Exposed Gypsum Board in Interior Wet Areas: Seal joints, cut edges, and holes with water-resistant sealant.
- D. Cementitious Backing Board: Install over steel framing members and plywood substrate where indicated, in accordance with ANSI A108.11 and manufacturer's instructions.
- E. Installation on Wood Framing: For rated assemblies, comply with requirements of listing authority. For non-rated assemblies, install as follows:
 - 1. Single-Layer Applications: Screw attachment.
 - 2. Double-Layer Application: Install base layer using screws. Install face layer using screws.

3.06 INSTALLATION OF TRIM AND ACCESSORIES

- A. Control Joints: Place control joints consistent with lines of building spaces and as follows:
 - 1. Not more than 30 feet (10 meters) apart on walls and ceilings over 50 feet (16 meters) long.
- B. Corner Beads: Install at external corners, using longest practical lengths.
- C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

3.07 JOINT TREATMENT

- A. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
 - 1. Level 5: Walls and ceilings to receive semi-gloss or gloss paint finish and other areas specifically indicated.
 - 2. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
 - 3. Level 3: Walls to receive textured wall finish.
 - 4. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.
 - 5. Level 1: Fire rated wall areas above finished ceilings, whether or not accessible in the completed construction.
- B. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
 - 1. Feather coats of joint compound so that camber is maximum 1/32 inch (0.8 mm).
 - 2. Taping, filling, and sanding is not required at surfaces behind adhesive applied ceramic tile and fixed cabinetry.
 - 3. Taping, filling and sanding is not required at base layer of double layer applications.
- C. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.
- D. Fill and finish joints and corners of cementitious backing board as recommended by manufacturer.

3.08 TEXTURE FINISH

- A. Apply finish texture coating by means of spraying apparatus in accordance with manufacturer's instructions and to match approved sample.

- B. Texture Required: Smooth finish texture at all walls and ceilings to be left exposed and finish painted and under all surfaces to receive wall coverings or custom treatments.

3.09 TOLERANCES

- A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet (3 mm in 3 m) in any direction.

END OF SECTION

SECTION 09 3000

TILING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Tile for floor applications.
- B. Tile for wall applications.
- C. Cementitious backer board as tile substrate.
- D. Ceramic accessories.
- E. Ceramic trim.
- F. Non-ceramic trim.

1.02 RELATED REQUIREMENTS

- A. Section 03 5400 - Cast Underlayment.
- B. Section 07 9200 - Joint Sealants: Sealing joints between tile work and adjacent construction and fixtures.
- C. Section 09 2116 - Gypsum Board Assemblies: Tile backer board.
- D. Section 22 4000 - Plumbing Fixtures: Shower receptor.

1.03 REFERENCE STANDARDS

- A. ANSI A108/A118/A136.1 - American National Standard Specifications for the Installation of Ceramic Tile - Version; 2014.
- B. ANSI A108.1A - American National Standard Specifications for Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar; 2014.
- C. ANSI A108.1B - American National Standard Specifications for Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar; 1999 (Reaffirmed 2010).
- D. ANSI A108.1C - Specifications for Contractors Option: Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Bed with Dry-Set or Latex-Portland Cement Mortar; 1999 (Reaffirmed 2010).
- E. ANSI A108.4 - American National Standard Specifications for Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile-Setting Epoxy Adhesive; 2009 (Revised).
- F. ANSI A108.5 - American National Standard Specifications for Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar; 1999 (Reaffirmed 2010).
- G. ANSI A108.6 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy; 1999 (Reaffirmed 2010).
- H. ANSI A108.8 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant Furan Resin Mortar and Grout; 1999 (Reaffirmed 2010).
- I. ANSI A108.9 - American National Standard Specifications for Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout; 1999 (Reapproved 2010).
- J. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework; 1999 (Reapproved 2010).
- K. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units; 2010 (Revised).
- L. ANSI A108.12 - American National Standard Specifications for Installation of Ceramic Tile with EGP (Exterior Glue Plywood) Latex-Portland Cement Mortar; 1999 (Reaffirmed 2010).

- M. ANSI A108.13 - American National Standard Specifications for Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone; 2005 (Reaffirmed 2010).
- N. ANSI A118.1 - American National Standard Specifications for Dry-Set Cement Mortar; 2012 (Revised).
- O. ANSI A118.3 - American National Standard Specifications for Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy and Water Cleanable Tile-Setting Epoxy Adhesive; 2013 (Revised).
- P. ANSI A118.4 - American National Standard Specifications for Modified Dry-Set Cement Mortar; 2012 (Revised).
- Q. ANSI A118.6 - American National Standard Specifications for Standard Cement Grouts for Tile Installation; 2010 (Revised).
- R. ANSI A118.7 - American National Standard Specifications for High Performance Cement Grouts for Tile Installation; 2010 (Revised).
- S. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units; 1999 (Reaffirmed 2010).
- T. ANSI A118.12 - American National Standard Specifications for Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation; 2014.
- U. ANSI A136.1 - American National Standard Specifications for Organic Adhesives for Installation of Ceramic Tile; 2008 (Reaffirmed 2013).
- V. ANSI A137.1 - American National Standard Specifications for Ceramic Tile - Version; 2013.1.
- W. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation; 2015.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.
- C. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, and thresholds.
- D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 6000 - Product Requirements, for additional provisions.
 - 2. Extra Tile: 10 square feet (1 square meters) of each size, color, and surface finish combination.

1.05 QUALITY ASSURANCE

- A. Maintain one copy of and ANSI A108/A118/A136.1 and TCNA (HB) on site.
- B. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum five years of documented experience.
- C. Installer Qualifications: Company specializing in performing tile installation, with minimum of five years of documented experience.

1.06 MOCK-UP

- A. See Section 01 4000 - Quality Requirements, for general requirements for mock-up.
- B. Construct tile mock-up where agreed to by owner, contractor and architect, incorporating all components specified for the location.
 - 1. Minimum size of mock-up is as required to fully demonstrate each type, color and pattern.
 - 2. Approved mock-up may remain as part of the Work.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.08 FIELD CONDITIONS

- A. Do not install solvent-based products in an unventilated environment.
- B. Maintain ambient and substrate temperature of 50 degrees F (10 degrees C) during installation of mortar materials.

PART 2 PRODUCTS

2.01 TILE

- A. Manufacturers: All products of each type by the same manufacturer.
 - 1. See Room Finish Schedule in the drawings for tile manufacturers, colors, finishes, sizes and locations.

2.02 TRIM AND ACCESSORIES

- A. Ceramic Accessories: Factory finish, same color and finish as adjacent field tile; same manufacturer as tile.
- B. Ceramic Trim: Matching bullnose, double bullnose, cove base, and cove ceramic shapes in sizes coordinated with field tile.
 - 1. Manufacturers: Same as for tile.
- C. Non-Ceramic Trim: Satin natural anodized extruded aluminum, style and dimensions to suit application, for setting using tile mortar or adhesive.

2.03 SETTING MATERIALS

- A. Manufacturers:
 - 1. All setting materials as recommended or approved by tile manufacturer for each specific application indicated on the drawings.
 - 2. Substitutions: See Section 01 6000 - Product Requirements.

2.04 GROUTS

- A. Epoxy Grout: ANSI A118.3 chemical resistant and water-cleanable epoxy grout.
 - 1. Applications: All tile locations unless otherwise noted.
 - 2. Color(s): As selected by Architect from manufacturer's full line.
 - 3. Products:
 - a. ARDEX Engineered Cements; ARDEX WA: www.ardexamericas.com.
 - b. Custom Building Products; CEG-IG 100% Solids Industrial Grade Epoxy Grout: www.custombuildingproducts.com.
 - c. LATICRETE International, Inc; LATICRETE SPECTRALOCK PRO Premium Grout: www.laticrete.com.
 - d. Merkrete, by Parex USA, Inc; Merkrete Pro Epoxy: www.merkrete.com.
 - e. ProSpec, an Oldcastle brand; B-7000 Epoxy Mortar and Grout: www.prospec.com.
 - f. Stuart Dean Company, Inc; Marcoat GS: www.stuartdean.com.
 - g. All grout materials as recommended or approved by tile manufacturer for each specific application indicated on the drawings.
 - h. Substitutions: See Section 01 6000 - Product Requirements.

2.05 MAINTENANCE MATERIALS

- A. Tile Sealant: Gunnable, silicone, siliconized acrylic, or urethane sealant; moisture and mildew resistant type.
 - 1. Applications: Between tile and plumbing fixtures.
 - 2. Color(s): To match adjacent plumbing fixture.
 - 3. Products:
 - a. ARDEX Engineered Cements; ARDEX SX: www.ardexamericas.com.
 - b. Custom Building Products; Commercial 100% Silicone Caulk: www.custombuildingproducts.com.
 - c. LATICRETE International, Inc; LATICRETE LATASIL: www.laticrete.com.
 - d. Merkrete, by Parex USA, Inc; Merkrete Colored Caulking: www.merkrete.com.

- e. ProSpec, an Oldcastle brand; ProColor Advantage Caulk: www.prospec.com.
- f. Substitutions: See Section 01 6000 - Product Requirements.

2.06 ACCESSORY MATERIALS

- A. Concrete Floor Slab Crack Isolation Membrane: Material complying with ANSI A118.12; not intended as waterproofing.
 - 1. Thickness: 20 mils (0.5 mm), maximum.
 - 2. Crack Resistance: No failure at 1/16 inch (1.6 mm) gap, minimum.
 - 3. Locations: All locations recommended by Tile Manufacturer.
- B. Backer Board: Cementitious type complying with ANSI A118.9; high density, glass fiber reinforced, 1/2 inch (12.7 mm) thick; 2 inch (51 mm) wide coated glass fiber tape for joints and corners.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.
- C. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of setting materials to sub-floor surfaces.
- D. Verify that concrete sub-floor surfaces are ready for tile installation by testing for moisture emission rate and alkalinity; obtain instructions if test results are not within limits recommended by tile manufacturer and setting materials manufacturer.
- E. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

- A. Protect surrounding work from damage.
- B. Vacuum clean surfaces and damp clean.
- C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.
- D. Install backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of setting material to a feather edge.
- E. Prepare substrate surfaces for adhesive installation in accordance with adhesive manufacturer's instructions.

3.03 INSTALLATION - GENERAL

- A. Install tile, thresholds, and stair treads and grout in accordance with applicable requirements of ANSI A108.1a thru A108.13, manufacturer's instructions, and TCNA (HB) recommendations.
- B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.
- C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.
- D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.
- E. Form internal angles square and external angles bullnosed.
- F. Install ceramic accessories rigidly in prepared openings.
- G. Install non-ceramic trim in accordance with manufacturer's instructions.
- H. Sound tile after setting. Replace hollow sounding units.
- I. Keep control and expansion joints free of mortar, grout, and adhesive.
- J. Prior to grouting, allow installation to completely cure; minimum of 48 hours.

- K. Grout tile joints unless otherwise indicated.
- L. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

3.04 INSTALLATION - FLOORS - THIN-SET METHODS

- A. Over interior concrete substrates, install in accordance with TCNA (HB) Method F113, dry-set or latex-Portland cement bond coat, with epoxy grout, unless otherwise indicated.
 - 1. Where epoxy bond coat and grout are indicated, install in accordance with TCNA (HB) Method F131.
 - 2. Where epoxy or furan grout is indicated, but not epoxy or furan bond coat, install in accordance with TCNA (HB) Method F115.

3.05 INSTALLATION - WALL TILE

- A. Over cementitious backer units on studs, install in accordance with TCNA (HB) Method W244, using membrane at toilet rooms and kitchens.
- B. Over gypsum wallboard on wood or metal studs install in accordance with TCNA (HB) Method W243, thin-set with dry-set or latex-Portland cement bond coat, unless otherwise indicated.
- C. Over interior concrete and masonry install in accordance with TCNA (HB) Method W202, thin-set with dry-set or latex-Portland cement bond coat.
- D. Over wood studs without backer install in accordance with TCNA (HB) Method W231, mortar bed, with membrane where indicated.

3.06 CLEANING

- A. Clean tile and grout surfaces.

3.07 PROTECTION

- A. Do not permit traffic over finished floor surface for 4 days after installation.

END OF SECTION

SECTION 09 5100
SUSPENDED ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Suspended metal grid ceiling system.
- B. Acoustical units.

1.02 RELATED REQUIREMENTS

- A. Section 07 2100 - Thermal Insulation: Acoustical insulation.
- B. Section 21 1300 - Fire Suppression Sprinklers: Sprinkler heads in ceiling system.
- C. Section 23 3700 - Air Outlets and Inlets: Air diffusion devices in ceiling.
- D. Section 26 5100 - Interior Lighting: Light fixtures in ceiling system.
- E. Section 27 5117 - Public Address Systems: Speakers in ceiling system.
- F. Section 28 3100 - Fire Detection and Alarm: Fire alarm components in ceiling system.

1.03 REFERENCE STANDARDS

- A. ASTM C635/C635M - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2013a.
- B. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2013.
- C. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2014.
- D. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2014.
- E. CHPS (HPPD) - High Performance Products Database; Current Edition at www.chps.net/.
- F. GEI (SCH) - GREENGUARD "Children and Schools" Certified Products; GREENGUARD Environmental Institute; current listings at www.greenguard.org.
- G. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth; 2015.
- H. UL (FRD) - Fire Resistance Directory; current edition.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.
- B. Do not install acoustical units until after interior wet work is dry.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate grid layout and related dimensioning.
- C. Product Data: Provide data on suspension system components.
- D. Manufacturer's Installation Instructions: Indicate special procedures.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 6000 - Product Requirements, for additional provisions.
 - 2. Extra Acoustical Units: 100 sq ft (1 sq m) of each type and size.

1.06 QUALITY ASSURANCE

- A. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

- B. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.07 FIELD CONDITIONS

- A. Maintain uniform temperature of minimum 60 degrees F (16 degrees C), and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

PART 2 PRODUCTS

2.01 ACOUSTICAL UNITS

- A. Acoustical Units - General: ASTM E1264, Class A.
- B. Acoustical Tile Type D: Painted mineral fiber, ASTM E1264 Type III, with the following characteristics:
 - 1. VOC Content: Certified as Low Emission by one of the following:
 - a. GreenGuard Children and Schools; www.greenguard.org.
 - b. Product listing in the CHPS High Performance Products Database; www.chps.net.
 - 2. Size: 24 by 48 inches (___ by ___ mm).(Second Look)
 - 3. Thickness: 3/4 inches (___ mm).
 - 4. Light Reflectance:.83 percent, determined in accordance with ASTM E1264.
 - 5. NRC Range:.5 to .55, determined in accordance with ASTM E1264.
 - 6. Ceiling Attenuation Class (CAC): 35, determined in accordance with ASTM E1264.
 - 7. Edge: Beveled tegular.
 - 8. Surface Color: White.
 - 9. Surface Pattern: Fine.
- C. Acoustical Tile Type E: Vinyl faced mineral fiber, ASTM E1264 Type IV, with the following characteristics:
 - 1. Size: 24 by 48 inches (___ by ___ mm).
 - 2. Thickness: 5/8 inches (15.9 mm).
 - 3. Light Reflectance:.88 percent, determined in accordance with ASTM E1264.
 - 4. Ceiling Attenuation Class (CAC): 40, determined in accordance with ASTM E1264.
 - 5. Edge: Square.
 - 6. Surface Color: White.
 - 7. Surface Pattern: Unperforated.

2.02 SUSPENSION SYSTEM(S)

- A. Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with stabilizer bars, clips, splices, perimeter moldings, and hold down clips as required.
- B. Exposed Steel Suspension System: Formed steel, commercial quality cold rolled; heavy-duty.
 - 1. Profile: Tee; 15/16 inch (24 mm) wide face.
 - 2. Construction: Double web.
 - 3. Finish: White painted.
 - 4. Products:
 - a. Same manufacturer as acoustical units.

2.03 ACCESSORIES

- A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.
- B. Perimeter Moldings: Same material and finish as grid.
 - 1. At Exposed Grid: Provide L-shaped molding for mounting at same elevation as face of grid.
- C. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that layout of hangers will not interfere with other work.

3.02 INSTALLATION - SUSPENSION SYSTEM

- A. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, and manufacturer's instructions and as supplemented in this section.
- B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.
- C. Locate system on room axis according to reflected plan.
- D. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.
- E. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
- F. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
- G. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
- H. Support fixture loads using supplementary hangers located within 6 inches (150 mm) of each corner, or support components independently.
- I. Do not eccentrically load system or induce rotation of runners.
- J. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
 - 1. Use longest practical lengths.
 - 2. Overlap and rivet corners.

3.03 INSTALLATION - ACOUSTICAL UNITS

- A. Install acoustical units in accordance with manufacturer's instructions.
- B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.
- C. Fit border trim neatly against abutting surfaces.
- D. Install units after above-ceiling work is complete.
- E. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.
- F. Cutting Acoustical Units:
 - 1. Cut to fit irregular grid and perimeter edge trim.
 - 2. Make field cut edges of same profile as factory edges.
 - 3. Double cut and field paint exposed reveal edges.
- G. Where round obstructions occur, provide preformed closures to match perimeter molding.
- H. Install hold-down clips on panels within 20 ft (6 m) of an exterior door.

3.04 TOLERANCES

- A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet (3 mm in 3 m).
- B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

END OF SECTION

SECTION 09 6813
TILE CARPETING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Carpet tile, fully adhered.
- B. Matching roll carpet for direct glue installation on stairs.

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors.
- B. Section 03 5400 - Cast Underlayment.

1.03 REFERENCE STANDARDS

- A. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2011.
- B. CRI 104 - Standard for Installation of Commercial Carpet; Carpet and Rug Institute; 2015.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.
- C. Samples: Submit two carpet tiles illustrating color and pattern design for each carpet color selected.
- D. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 6000 - Product Requirements, for additional provisions.
 - 2. Extra Carpet Tiles: Quantity equal to 5 percent of total installed of each color and pattern installed.
 - 3. Extra Roll Carpet: 100 sq ft (1 sq m) of each type, color, and pattern installed.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing specified carpet tile with minimum three years documented experience.
- B. Installer Qualifications: Company specializing in installing carpet tile with minimum three years documented experience and approved by carpet tile manufacturer.

1.06 FIELD CONDITIONS

- A. Store materials in area of installation for minimum period of 24 hours prior to installation.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Tile Carpeting: Tufted, manufactured in one color dye lot.
 - 1. Product: As indicated on Room Finish Schedule manufactured by company indicated on Room Finish Schedule.
 - 2. Tile Size: 18 by 18 inch (450 by 450 mm), nominal.
 - 3. Color: As indicated on Room Finish Schedule.
 - 4. Pattern: As indicated on Room Finish Schedule.
- B. Roll Carpet: Same manufacturer, type, color and pattern, and face fiber characteristics as carpet tile, 12 feet (____ m) wide, manufactured in same color dye lot as tile carpet CP-03.

2.02 ACCESSORIES

- A. Sub-Floor Filler: White premix latex; type recommended by flooring material manufacturer.

- B. Edge Strips: Embossed aluminum, _____ color.
- C. Adhesives:
 - 1. Compatible with materials being adhered; maximum VOC content of 50 g/L; CRI (GLP) certified; in lieu of labeled product, independent test report showing compliance is acceptable.
- D. Carpet Tile Adhesive: Recommended by carpet tile manufacturer; releasable type.
- E. Roll Carpet Adhesive: Type recommended by roll carpet manufacturer for specified application.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that sub-floor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.
- B. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to sub-floor surfaces.
- C. Cementitious Sub-floor Surfaces: Verify that substrates are dry enough and ready for flooring installation by testing for moisture and pH.
 - 1. Test in accordance with ASTM F710.
 - 2. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.
- D. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

- A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

3.03 INSTALLATION

- A. Starting installation constitutes acceptance of sub-floor conditions.
- B. Install carpet tile in accordance with manufacturer's instructions.
- C. Blend carpet from different cartons to ensure minimal variation in color match.
- D. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.
- E. Lay carpet tile in square pattern, with pile direction parallel to next unit, set parallel to building lines.
- F. Fully adhere carpet tile to substrate.
- G. Trim carpet tile neatly at walls and around interruptions.
- H. Complete installation of edge strips, concealing exposed edges.

3.04 INSTALLATION ON STAIRS

- A. Use one piece of carpet for each tread and the riser below. Apply seam adhesive to all cut edges.
- B. Lay carpet with pile direction in the length of the stair.
- C. Adhere carpet tight to stair treads and risers.

3.05 CLEANING

- A. Remove excess adhesive without damage, from floor, base, and wall surfaces.
- B. Clean and vacuum carpet surfaces.

END OF SECTION

SECTION 09 7200
WALL COVERINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface preparation and prime painting.
- B. Wall covering.

1.02 REFERENCE STANDARDS

- A. ASTM D1308 - Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes; 2002 (Reapproved 2013).
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
- C. ASTM F793 - Standard Classification of Wall Covering by Use Characteristics; 2010a.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on wall covering and adhesive.
- C. Samples: Submit two samples of wall covering, 6 by 6 inch (____by____ mm) in size illustrating color, finish, and texture.
- D. Test Reports: Indicate verification of flame and smoke ratings, when tested by UL.
- E. Manufacturer's Installation Instructions: Indicate special procedures.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 6000 - Product Requirements, for additional provisions.
 - 2. Extra Wall Covering Materials: 25 linear feet (8 linear m) of each color and pattern of wall covering; store where directed.
 - 3. Package and label each roll by manufacturer, color and pattern, and destination room number.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.05 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the adhesive or wall covering product manufacturer.
- B. Maintain these conditions 24 hours before, during, and after installation of adhesive and wall covering.
- C. Provide lighting level of 80 ft candles (860 lx) measured mid-height at substrate surfaces.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design - Wall Coverings: As indicated on Room Finish Schedule.

2.02 MATERIALS

- A. Requirements for Wall Coverings:
 - 1. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84.
 - 2. Chemical and Stain Resistance: No visible staining or discoloration and no damage to surface texture when tested in accordance with ASTM D1308.
- B. Adhesive: Type recommended by wall covering manufacturer to suit application to substrate.

- C. Termination Trim: Extruded plastic, clear.
- D. Substrate Filler: As recommended by adhesive and wall covering manufacturers; compatible with substrate.
- E. Substrate Primer and Sealer: Alkyd enamel type.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate surfaces are prime painted and ready to receive work, and conform to requirements of the wall covering manufacturer.
- B. Measure moisture content of surfaces using an electronic moisture meter. Do not apply wall coverings if moisture content of substrate exceeds level recommended by wall covering manufacturer.
- C. Verify flatness tolerance of surfaces does not vary more than 1/8 inch in 10 feet (3 mm in 3 m) nor vary at a rate greater than 1/16 inch/ft (1.5 mm/300 mm).

3.02 PREPARATION

- A. Fill cracks in substrate and smooth irregularities with filler; sand smooth.
- B. Wash impervious surfaces with tetra-sodium phosphate, rinse and neutralize; wipe dry.
- C. Surface Appurtenances: Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.
- D. Apply one coat of primer sealer to substrate surfaces. Allow to dry. Lightly sand smooth.
- E. Vacuum clean surfaces free of loose particles.

3.03 INSTALLATION

- A. Apply adhesive and wall covering in accordance with manufacturer's instructions.
- B. Install termination trim.

3.04 CLEANING

- A. Clean wall coverings of excess adhesive, dust, dirt, and other contaminants.
- B. Reinstall wall plates and accessories removed prior to work of this section.

3.05 PROTECTION

- A. Do not permit construction activities at or near finished wall covering areas.

END OF SECTION

SECTION 09 7733
GLASS FIBER REINFORCED PLASTIC PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Glass fiber reinforced plastic panels.
- B. Trim.

1.02 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.

1.03 DELIVERY, STORAGE, AND HANDLING

- A. Store panels flat, indoors, on a clean, dry surface. Remove packaging and allow panels to acclimate to room temperature for 48 hours prior to installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Glass Fiber Reinforced Plastic Panels:
 - 1. Crane Composites, Inc; _____: www.cranecomposites.com.
 - 2. Marlite; _____: www.marlite.com.
 - 3. Nudo; _____: www.nudo.com.
 - 4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PANEL SYSTEMS

- A. Wall Panels:
 - 1. Panel Size: 4 by 8 feet (1.2 by 2.4 m).
 - 2. Panel Thickness: 0.10 inch (2.5 mm).
 - 3. Surface Design: Smooth.
 - 4. Color: White.
 - 5. Attachment Method: Adhesive only, with trim and sealant in joints.

2.03 MATERIALS

- A. Panels: Glass fiber reinforced plastic (FRP), complying with ASTM D5319.
 - 1. Surface Burning Characteristics: Maximum flame spread index of 25 and smoke developed index of 450; when system tested in accordance with ASTM E84.
- B. Trim: Vinyl; color coordinating with panel.
- C. Adhesive: Type recommended by panel manufacturer.
- D. Sealant: Type recommended by panel manufacturer; white.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions and substrate flatness before starting work.
- B. Verify that substrate conditions are ready to receive the work of this section.

3.02 INSTALLATION - WALLS

- A. Install panels in accordance with manufacturer's instructions.
- B. Cut and drill panels with carbide tipped saw blades, drill bits, or snips.
- C. Apply adhesive to the back side of the panel using trowel as recommended by adhesive manufacturer.
- D. Apply panels to wall with seams plumb and pattern aligned with adjoining panels.
- E. Install panels with manufacturer's recommended gap for panel field and corner joints.

- F. Place trim on panel before fastening edges, as required.
- G. Fill channels in trim with sealant before attaching to panel.
- H. Install trim with adhesive and screws or nails, as required.
- I. Seal gaps at floor, ceiling, and between panels with applicable sealant to prevent moisture intrusion.
- J. Remove excess sealant after paneling is installed and prior to curing.

END OF SECTION

SECTION 09 9113
EXTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints and stains.
- C. Scope: Finish exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:
 - 1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
 - 2. Exposed surfaces of steel lintels and ledge angles.
 - 3. Mechanical and Electrical:
 - a. On the roof and outdoors, paint equipment that is exposed to weather or to view, not including factory-finished materials.
- D. Do Not Paint or Finish the Following Items:
 - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
 - 2. Items indicated to receive other finishes.
 - 3. Items indicated to remain unfinished.
 - 4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
 - 5. Floors, unless specifically indicated.
 - 6. Glass.
 - 7. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

- A. Section 05 5000 - Metal Fabrications: Shop-primed items.
- B. Section 09 9123 - Interior Painting.

1.03 REFERENCE STANDARDS

- A. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials; 2007.
- B. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; current edition, www.paintinfo.com.
- C. SSPC-SP 1 - Solvent Cleaning; 2015.
- D. SSPC-SP 2 - Hand Tool Cleaning; 1982 (Ed. 2004).
- E. SSPC-SP 6 - Commercial Blast Cleaning; Society for Protective Coatings; 2007.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:
 - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
 - 2. MPI product number (e.g. MPI #47).
 - 3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
- C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches (216 by 279 mm) in size, illustrating range of colors available for each finishing product specified.
 - 1. Where sheen is specified, submit samples in only that sheen.
- D. Manufacturer's Instructions: Indicate special surface preparation procedures.

- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 6000 - Product Requirements, for additional provisions.
 - 2. Extra Paint and Finish Materials: 1 gallon (4 L) of each color; from the same product run, store where directed.
 - 3. Label each container with color in addition to the manufacturer's label.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum three years experience and approved by manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

1.07 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Provide lighting level of 80 ft candles (860 lx) measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.
- B. Paints:
 - 1. Benjamin Moore & Co: www.benjaminmoore.com.
 - 2. Diamond Vogel Paints: www.diamondvogel.com.
 - 3. PPG Paints: www.ppgpaints.com.
 - 4. Pratt & Lambert Paints: www.prattandlambert.com.
 - 5. Sherwin-Williams Company: www.sherwin-williams.com.
- C. Transparent Finishes:
 - 1. Behr Process Corporation: www.behr.com.
 - 2. Sherwin-Williams Company: www.sherwin-williams.com.
- D. Stains:
 - 1. Behr Process Corporation: www.behr.com.
 - 2. Sherwin-Williams Company: www.sherwin-williams.com.
- E. Primer Sealers: Same manufacturer as top coats.
- F. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PAINTS AND FINISHES - GENERAL

- A. Paints and Finishes: Ready mixed, unless required to be a field-catalyzed paint.
 - 1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.

2. Supply each paint material in quantity required to complete entire project's work from a single production run.
3. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

2.03 PAINT SYSTEMS - EXTERIOR

- A. Paint E-OP - Exterior Surfaces to be Painted, Unless Otherwise Indicated: Including fiber cement siding, primed wood, and primed metal.
 1. Two top coats and one coat primer.
 2. Top Coat(s): Exterior Latex; MPI #10, 11, 15, 119, or 214.
 - a. Products:
 - 1) Behr Marquee Exterior Flat [No. 4450]. (MPI #10)
 - 2) Behr Marquee Exterior Semi-Gloss Enamel [No. 5450]. (MPI #11)
 - 3) Pratt & Lambert Pro-Hide Gold Exterior Latex, Flat.
 - 4) Pratt & Lambert Pro-Hide Gold Exterior Latex, Semi-Gloss. (MPI #11)
 - 5) Valspar Emblem Exterior Latex, No. 56500 Series, Flat.
 - 6) Valspar Professional Exterior, No. 12900 Series, Semi-Gloss.
 - 7) Equal or greater product systems from Benjamin Moore and Sherwin Williams are also acceptable..
 - 8) Substitutions: Section 01 6000 - Product Requirements.
 3. Top Coat(s): Exterior Alkyd Enamel; MPI #94.
 4. Top Coat Sheen:
 - a. Flat: MPI gloss level 1; use this sheen for overhead surfaces.
 - b. Semi-Gloss: MPI gloss level 5; use this sheen at all locations.
 5. Primer: As recommended by top coat manufacturer for specific substrate.
- B. Paint E-TR-W - Stain on Wood:
 1. 2 coats stain.
 2. Stain: Exterior Semi-Transparent Stain for Wood, Water Based; MPI #156.
 - a. Products:
 - 1) Behr Premium Semi-Transparent Weatherproofing Wood Stain No. 5077 Tint Base.
 - 2) Rodda WeatherOne Exterior Semi-Transparent Stain, 06680. (MPI #156)
 - 3) Equal or greater product systems from Benjamin Moore and Sherwin Williams are also acceptable..

2.04 PRIMERS

- A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.

2.05 ACCESSORY MATERIALS

- A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.
- B. Patching Material: Latex filler.
- C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.
- C. Test shop-applied primer for compatibility with subsequent cover materials.
- D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
 1. Fiber Cement Siding: 12 percent.

2. Exterior Wood: 15 percent, measured in accordance with ASTM D4442.

3.02 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing.
- D. Seal surfaces that might cause bleed through or staining of topcoat.
- E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- F. Fiber Cement Siding: Remove dirt, dust and other foreign matter with a stiff fiber brush. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
- G. Galvanized Surfaces:
 1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
 2. Prepare surface according to SSPC-SP 2.
- H. Ferrous Metal:
 1. Solvent clean according to SSPC-SP1.
 2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces.
 3. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.
- I. Exterior Wood Surfaces to Receive Opaque Finish: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior calking compound after prime coat has been applied. Back prime concealed surfaces before installation.
- J. Exterior Wood to Receive Transparent Finish: Remove dust, grit, and foreign matter; seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes with tinted exterior calking compound after sealer has been applied. Prime concealed surfaces.
- K. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.03 APPLICATION

- A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- B. Exterior Wood to Receive Opaque Finish: If final painting must be delayed more than 2 weeks after installation of woodwork, apply primer within 2 weeks and final coating within 4 weeks.
- C. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
- D. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.
- E. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- F. Apply each coat to uniform appearance.
- G. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply additional coats until complete hide is achieved.
- H. Sand wood and metal surfaces lightly between coats to achieve required finish.
- I. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

- J. Wood to Receive Transparent Finishes: Tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.
- K. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection.

3.05 PROTECTION

- A. Protect finishes until completion of project.
- B. Touch-up damaged finishes after Substantial Completion.

3.06 COLOR SCHEDULE

- A. See associated specification sections for color selections.

END OF SECTION

SECTION 09 9123
INTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints, stains, and varnishes.
- C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
 - 1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
 - 2. Elevator pit ladders.
 - 3. Surfaces inside cabinets.
 - 4. Prime surfaces to receive wall coverings.
 - 5. Exposed walls and bottom of swimming pools.
 - 6. Mechanical and Electrical:
 - a. In finished areas, paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment, unless otherwise indicated.
 - b. In finished areas, paint shop-primed items.
- D. Do Not Paint or Finish the Following Items:
 - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
 - 2. Items indicated to receive other finishes.
 - 3. Items indicated to remain unfinished.
 - 4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
 - 5. Floors, unless specifically indicated.
 - 6. Glass.
 - 7. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

- A. Section 05 5000 - Metal Fabrications: Shop-primed items.
- B. Section 09 9113 - Exterior Painting.

1.03 REFERENCE STANDARDS

- A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.
- B. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials; 2007.
- C. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; current edition, www.paintinfo.com.
- D. SSPC-SP 1 - Solvent Cleaning; 2015.
- E. SSPC-SP 6 - Commercial Blast Cleaning; Society for Protective Coatings; 2007.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:
 - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
 - 2. MPI product number (e.g. MPI #47).

3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
- C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches (216 by 279 mm) in size, illustrating range of colors available for each finishing product specified.
 1. Where sheen is specified, submit samples in only that sheen.
- D. Manufacturer's Instructions: Indicate special surface preparation procedures.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 1. See Section 01 6000 - Product Requirements, for additional provisions.
 2. Extra Paint and Finish Materials: 1 gallon (4 L) of each color; from the same product run, store where directed.
 3. Label each container with color in addition to the manufacturer's label.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum three years experience and approved by manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

1.07 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Provide lighting level of 80 ft candles (860 lx) measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.
- B. Paints:
 1. Benjamin Moore & Co: www.benjaminmoore.com.
 2. Diamond Vogel Paints: www.diamondvogel.com.
 3. PPG Paints: www.ppgpaints.com.
 4. Pratt & Lambert Paints: www.prattandlambert.com.
 5. Sherwin-Williams Company: www.sherwin-williams.com.
- C. Primer Sealers: Same manufacturer as top coats.
- D. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PAINTS AND FINISHES - GENERAL

- A. Paints and Finishes: Ready mixed, unless intended to be a field-catalyzed paint.
 1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.

2. Supply each paint material in quantity required to complete entire project's work from a single production run.
 3. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.
- B. Colors: As indicated on drawings.
1. Extend colors to surface edges; colors may change at any edge as directed by Architect.
 2. In all areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling they are mounted on/under.

2.03 PAINT SYSTEMS - INTERIOR

- A. Paint I-OP - Interior Surfaces to be Painted, Unless Otherwise Indicated: Including gypsum board, concrete masonry units, wood, shop primed steel, galvanized steel, and aluminum.
1. Two top coats and one coat primer.
 2. Top Coat(s): Interior Latex; MPI #43, 44, 52, 53, 54, or 114.
 - a. Products:
 - 1) Behr Marquee Interior Eggshell Enamel [No.2450]. (MPI #52)
 - 2) Behr Premium Plus Interior Flat [No. 1050]. (MPI #53)
 - 3) PPG Paints Speedhide zero Latex, 6-4110XI Series, Flat. (MPI #53)
 - 4) PPG Paints Speedhide zero Latex, 6-4310XI Series, Eggshell. (MPI #44)
 - 5) Pratt & Lambert Pro-Hide Gold Interior Latex, Flat.
 - 6) Pratt & Lambert Pro-Hide Gold Interior Latex, Eggshell.
 - 7) Sherwin-Williams Harmony Interior Acrylic Latex, Flat. (MPI #53)
 - 8) Sherwin-Williams Harmony Interior Acrylic Latex, Egg-Shel. (MPI #44)
 - 9) Interior paint systems from Benjamin Moore of equal or greater quality are acceptable..
 - 10) Substitutions: Section 01 6000 - Product Requirements.
 3. Top Coat Sheen:
 - a. Flat: MPI gloss level 1; use this sheen for ceilings and other overhead surfaces.
 - b. Eggshell: MPI gloss level 3; use this sheen at all wall locations.
 4. Primer: As recommended by top coat manufacturer for specific substrate.
- B. Paint I-OP-MD-DT - Medium Duty Door/Trim: For surfaces subject to frequent contact by occupants, including metals:
1. Medium duty applications include doors, door frames, railings, handrails, guardrails, and balustrades.
 2. Two top coats and one coat primer.
 3. Top Coat(s): High Performance Architectural Interior Latex; MPI #139, 140, or 141.
 - a. Products:
 - 1) Sherwin-Williams Pro Industrial Pre-Catalyzed Waterbased Epoxy, Semi-Gloss. (MPI #141)
 - 2) Interior paint systems from Benjamin Moore of equal or greater quality are acceptable..
 - 3) Substitutions: Section 01 6000 - Product Requirements.
- C. Paint I-TR -W - Transparent Finish on Wood.
1. 2 top coats over sanding sealer, no stain.
 2. Top Coat(s): Polyurethane Varnish, Oil Modified; MPI #56 or 57.
 - a. Products:
 - 1) Sherwin-Williams Wood Classics Polyurethane Varnish, Satin. (MPI #57)
 - 2) Substitutions: Section 01 6000 - Product Requirements.

2.04 PRIMERS

- A. Primers: Provide the primer that is required or recommended by manufacturer of top coats.

2.05 ACCESSORY MATERIALS

- A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

- B. Patching Material: Latex filler.
- C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.
- C. Test shop-applied primer for compatibility with subsequent cover materials.
- D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
 - 1. Gypsum Wallboard: 12 percent.
 - 2. Masonry, Concrete, and Concrete Masonry Units : 12 percent.
 - 3. Interior Wood: 15 percent, measured in accordance with ASTM D4442.

3.02 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
- D. Seal surfaces that might cause bleed through or staining of topcoat.
- E. Masonry:
 - 1. Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
 - 2. Prepare surface as recommended by top coat manufacturer.
- F. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.
- G. Aluminum: Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
- H. Galvanized Surfaces:
- I. Ferrous Metal:
 - 1. Solvent clean according to SSPC-SP1.
 - 2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
 - 3. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.
- J. Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.
- K. Wood Surfaces to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats. Prime concealed surfaces with gloss varnish reduced 25 percent with thinner.
- L. Wood Doors to be Field-Finished: Seal wood door top and bottom edge surfaces with clear sealer.

3.03 APPLICATION

- A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
- C. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.
- D. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- E. Apply each coat to uniform appearance in thicknesses specified by manufacturer.
- F. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as necessary for complete hide.
- G. Sand wood and metal surfaces lightly between coats to achieve required finish.
- H. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- I. Wood to Receive Transparent Finishes: Tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.
- J. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection.

3.05 PROTECTION

- A. Protect finishes until completion of project.
- B. Touch-up damaged finishes after Substantial Completion.

3.06 COLOR SCHEDULE

- A. As indicated on Room Finish Schedule located in the drawings.

END OF SECTION

SECTION 10 2800
TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Accessories for toilet rooms, showers, and utility rooms.
- B. Electrically operated paper towel dispensers.
- C. Grab bars.

1.02 RELATED REQUIREMENTS

- A. Section 06 1000 - Rough Framing: Concealed supports for accessories, including in wall framing and plates and above ceiling framing.

1.03 REFERENCE STANDARDS

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.
- C. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2015.
- D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.
- E. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.
- F. ASTM B456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium; 2011.
- G. ASTM C1036 - Standard Specification for Flat Glass; 2011.
- H. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2012.
- I. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror; 2008 (Reapproved 2013).
- J. ASTM F2285 - Standard Consumer Safety Performance Specification for Diaper Changing Tables for Commercial Use; 2004 (Reapproved 2010).

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the work with the placement of internal wall reinforcement and concealed ceiling supports to receive anchor attachments.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.
- C. Samples: Submit two samples of each accessory, illustrating color and finish.
- D. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Toilet Accessories:
 - 1. AJW Architectural Products; -: www.ajw.com.
 - 2. ASI - American Specialties, Inc; -: www.americanspecialties.com.
 - 3. Bradley Corporation; -: www.bradleycorp.com.
 - 4. Bobrick Washroom Equipment: www.bobrick.com.
 - 5. Substitutions: Section 01 6000 - Product Requirements.

- B. All items of each type to be made by the same manufacturer.

2.02 MATERIALS

- A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
- B. Keys: Provide _____ keys for each accessory to Owner; master key lockable accessories.
- C. Stainless Steel Sheet: ASTM A666, Type 304.
- D. Stainless Steel Tubing: ASTM A269/A269M, Type 304 or 316.
- E. Mirror Glass: Annealed float glass, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503.
- F. Mirror Glass: Tempered safety glass, ASTM C1048; and ASTM C1036 Type I, Class 1, Quality Q2, with silvering as required.
- G. Adhesive: Two component epoxy type, waterproof.
- H. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.

2.03 FINISHES

- A. Stainless Steel: No. 4 Brushed finish, unless otherwise noted.

2.04 TOILET ROOM ACCESSORIES

- A. Toilet Paper Dispenser: Roll-in-reserve type, designed to allow automatic activation of reserve roll when needed, or manual activation by pressing release bar, surface-mounted, stainless steel unit with pivot hinge, tumbler lock.
- B. Paper Towel Dispenser: Electric, roll paper type.
 - 1. Cover: Stainless steel.
 - 2. Paper Discharge: Auto-cut dispense.
 - 3. Capacity: 6 inch diameter roll.
 - 4. Mounting: Surface mounted.
 - 5. Power: Battery operated.
 - 6. Refill Indicator: Illuminated refill indicator.
- C. Waste Receptacle: Stainless steel, freestanding style with swing top.
 - 1. Liner: Removable seamless stainless steel receptacle.
 - 2. Minimum capacity: 10 gallons (38 liters).
 - 3. Quantity: One per public restroom.
- D. Soap Dispenser: Liquid soap dispenser, wall-mounted, surface, with stainless steel cover and horizontal stainless steel tank and working parts; push type soap valve, check valve, and window gage refill indicator, tumbler lock.
- E. Mirrors: Decorative painted wood framed, 1/4 inch (6 mm) thick annealed float glass; ASTM C1036.
 - 1. Annealed Float Glass: Silvering, protective and physical characteristics in compliance with ASTM C1503.
 - 2. Size: As indicated on the drawings.
 - 3. Frame: Color and style as directed by Hilton Supply Management to comply with Hilton Brand Standards.
 - 4. Backing: Full-mirror sized, minimum 0.03 inch (0.8 mm) galvanized steel sheet and nonabsorptive filler material.
- F. Grab Bars: Stainless steel, nonslip grasping surface finish.
 - 1. Standard Duty Grab Bars:
 - a. Push/Pull Point Load: 250 pound-force (1112 N), minimum.
 - b. Dimensions: 1-1/4 inch (32 mm) outside diameter, minimum 0.05 inch (1.3 mm) wall thickness, exposed flange mounting, 1-1/2 inch (38 mm) clearance between wall and inside of grab bar.
 - c. Length and Configuration: As indicated on drawings.

- G. Combination Sanitary Napkin/Tampon Dispenser: Stainless steel, surface-mounted.
 - 1. Door: Seamless 0.05 inch (1.3 mm) door with returned edges and tumbler lock.
 - 2. Cabinet: Fully welded, 0.03 inch (0.8 mm) thick sheet.
 - 3. Operation: No charge; no coin slots.
 - 4. Identify dispensers slots without using brand names.
 - 5. Minimum capacity: 15 napkins and 20 tampons.
- H. Facial Tissue Dispenser: Surface, wall-mounted, 0.03 inch (0.8 mm) satin-finished stainless steel face plate with roll edges at opening, corrosion-resistant steel cabinet.
 - 1. Minimum capacity: 200 tissues.
- I. Diaper Changing Station: Wall-mounted folding diaper changing station for use in commercial toilet facilities, meeting or exceeding ASTM F2285.
 - 1. Style: Horizontal.
 - 2. Material: Stainless steel shell with polyethylene body.
 - 3. Mounting: Surface.
 - 4. Minimum Rated Load: 250 lbs (113.4 kg).
 - 5. Location: West wall of Unisex Restroom 017.
- J. Substitutions: 01 6000 - Product Requirements.
- K. See Toilet Accessories Legend on Sheet A4.41 of the drawings for more information

2.05 SHOWER AND TUB ACCESSORIES

- A. Robe Hook: Heavy-duty stainless steel, double-prong, rectangular-shaped bracket and backplate for concealed attachment, satin finish.

2.06 UTILITY ROOM ACCESSORIES

- A. Mop and Broom Holder: 0.05 inch (1.3 mm) thick stainless steel, Type 304, hat-shaped channel.
 - 1. Holders: 4 spring-loaded rubber cam holders.
 - 2. Length: 36 inches (900 mm).
 - 3. Mounting: Surface wall mounted above each mop sink.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify exact location of accessories for installation.
- C. For electrically-operated accessories, verify that electrical power connections are ready and in the correct locations.
- D. See Section 06 1000 - Rough Carpentry for installation of blocking, reinforcing plates, and concealed anchors in walls and ceilings.

3.02 PREPARATION

- A. Deliver inserts and rough-in frames to site for timely installation.
- B. Provide templates and rough-in measurements as required.

3.03 INSTALLATION

- A. Install accessories in accordance with manufacturers' instructions in locations indicated on the drawings.
- B. Install plumb and level, securely and rigidly anchored to substrate.
- C. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.

END OF SECTION

SECTION 10 4400
FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fire extinguishers.
- B. Fire extinguisher cabinets.
- C. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 06 1000 - Rough Carpentry: Wood blocking product and execution requirements.

1.03 REFERENCE STANDARDS

- A. NFPA 10 - Standard for Portable Fire Extinguishers; 2013.
- B. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate cabinet physical dimensions.
- C. Product Data: Provide extinguisher operational features.
- D. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.

1.05 FIELD CONDITIONS

- A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Fire Extinguishers:
 - 1. Ansul, a Tyco Business; -: www.ansul.com.
 - 2. Nystrom, Inc; -: www.nystrom.com.
 - 3. Pyro-Chem, a Tyco Business; -: www.pyrochem.com.
 - 4. Strike First Corporation of America; Water Fire Extinguisher: www.strikefirstusa.com.
 - 5. Substitutions: See Section 01 6000 - Product Requirements.
- B. Fire Extinguisher Cabinets and Accessories:
 - 1. Ansul, a Tyco Business; -: www.ansul.com.
 - 2. JL Industries, Inc; -: www.jlindustries.com.
 - 3. Nystrom, Inc; -: www.nystrom.com.
 - 4. Pyro-Chem, a Tyco Business; -: www.pyrochem.com.
 - 5. Strike First Corporation of America; EL-Elite Architectural Series Fire Extinguisher Cabinet, Non-Fire Rated: www.strikefirstusa.com.
 - 6. Substitutions: See Section 01 6000 - Product Requirements.

2.02 FIRE EXTINGUISHERS

- A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
 - 1. Provide extinguishers labeled by UL (DIR) for the purpose specified and indicated.
- B. Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gage.
 - 1. Class: A:B:C.
 - 2. Size and classification as required by area served.
 - 3. Finish: Baked polyester powder coat, red color.

2.03 FIRE EXTINGUISHER CABINETS

- A. Metal: Formed primed steel sheet; 0.036 inch (0.9 mm) thick base metal.
- B. Cabinet Configuration: Recessed type.
 - 1. Sized to accommodate accessories.
 - 2. Form cabinet enclosure with right angle inside corners and seams. Form perimeter trim and door stiles.
- C. Door: 0.036 inch (0.9 mm) thick, reinforced for flatness and rigidity; latch. Hinge doors for 180 degree opening with two butt hinge. Provide nylon catch.
- D. Door Glazing: Glass, clear, 1/8 inch (3 mm) thick float. Set in resilient channel gasket glazing.
- E. Cabinet Mounting Hardware: Appropriate to cabinet. Pre-drill for anchors.
- F. Finish of Cabinet Exterior Trim and Door: Baked enamel, color as selected.
- G. Finish of Cabinet Interior: White enamel.

2.04 ACCESSORIES

- A. Extinguisher Brackets: Formed steel, chrome-plated.
- B. Cabinet Signage: As required by applicable codes.
- C. Knox Box: Model number 3200 surface mounted, located near main entry door 001A. Confirm exact location with authority having jurisdiction.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install cabinets plumb and level in wall openings, 36 inches (____ mm) from finished floor to inside bottom of cabinet.
- C. Secure rigidly in place.
- D. Place extinguishers and accessories in cabinets.

END OF SECTION

SECTION 14 2400
HYDRAULIC ELEVATORS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Complete hydraulic elevator systems.
 - 1. Passenger type.
 - 2. Service type.
- B. Elevator Maintenance Contract.

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete: Includes elevator machine foundation, enclosed hoistway, and elevator pit.
- B. Section 04 2000 - Unit Masonry: Masonry hoistway enclosure; building-in and grouting hoistway door frames.
- C. Section 05 1200 - Structural Steel Framing: Includes hoistway framing, divider beams, and overhead hoist beams.
- D. Section 05 5000 - Metal Fabrications: Includes elevator pit ladder and sill supports.
- E. Section 07 8400 - Firestopping: Fire rated sealant in hoistway.
- F. Section 09 9300 - Tiling: Floor finish in car.
- G. Section 21 1300 - Fire Suppression Sprinklers: Sprinkler heads in hoistway.
- H. Section 22 3000 - Plumbing Equipment: Pit drain.
- I. Section 26 3600 - Transfer Switches: For interface with elevator controls.
- J. Section 28 3100 - Fire Detection and Alarm:
 - 1. Fire and smoke detectors and interconnecting devices.
 - 2. Fire alarm signal lines to elevator controller cabinet.

1.03 REFERENCE STANDARDS

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- B. AISC 360 - Specification for Structural Steel Buildings; 2010.
- C. ASME A17.1 - Safety Code for Elevators and Escalators; 2013.
- D. ASME A17.2 - Guide for Inspection of Elevators, Escalators, and Moving Walks; 2014.
- E. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015.
- F. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.
- G. NEMA MG 1 - Motors and Generators; 2014.
- H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- I. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2016.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the work with other installers to provide conduits necessary for installation of wiring including but not limited to:
 - a. To elevator equipment devices remote from elevator machine room or hoistway.
 - b. To machine room for telephone service.
 - c. To elevator pit for lighting and sump pump.
 - d. To automatic transfer switch from controller cabinet.
 - e. To fire alarm panel from controller cabinet.
 - 2. Coordinate the work with other installers for equipment provisions necessary for proper elevator operation including but not limited to:

- a. Automatic transfer switches with auxiliary contacts for emergency power transfer status indication.
 - b. Shunt trip devices for automatic disconnection of elevator power prior to fire suppression system activation.
 - c. Overcurrent protection devices selected to achieve required selective coordination.
- B. Preinstallation Meeting: Convene a meeting one week prior to starting work.
 - 1. Review schedule of installation, installation procedures and conditions, and coordination with related work.
 - 2. Review use of elevator for construction purposes, hours of use, scheduling of use, cleanliness of car, employment of operator, and maintenance of system.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on the following items.
 - 1. Signal and operating fixtures, operating panels, and indicators.
 - 2. Car design, dimensions, layout, and components.
 - 3. Car and hoistway door and frame details.
 - 4. Electrical characteristics and connection requirements.
- C. Shop Drawings: Indicate the following information.
 - 1. Locations of Elevator Machine Equipment: Driving machines, power units, controllers, and other component.
 - 2. Hoistway Components: Car guide rails, buffers, jack unit and other components.
 - 3. Rail bracket spacing; maximum loads imposed on guide rails requiring load transfer to building structural framing.
 - 4. Clearances and over-travel of car.
 - 5. Locations in hoistway and machine room of traveling cables and connections for car lighting and telephone.
 - 6. Location and sizes of doors and frames.
 - 7. Electrical characteristics and connection requirements.
 - 8. Show arrangement of elevator equipment in machine room, and allow for clear passage of equipment through access door.
- D. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- E. Initial Maintenance Contract.
- F. Maintenance Contract: Submit proposal to Owner for standard one year continuing maintenance contract agreement in accordance with ASME A17.1 and requirements as indicated, starting on date initial maintenance contract is scheduled to expire.
 - 1. Indicate in proposal the services, obligations, conditions, and terms for agreement period and for renewal options.
- G. Operation and Maintenance Data:
 - 1. Parts catalog with complete list of equipment replacement parts; identify each entry with equipment description and identifying code.
 - 2. Operation and maintenance manual.
 - 3. Schematic drawings and wiring diagrams.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum ten years documented experience.
- B. Installer Qualifications: Company specializing in performing the work of this section and approved by elevator equipment manufacturer.

1.07 WARRANTY

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

- B. Provide 12 month manufacturer warranty for elevator operating equipment and devices from Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Hydraulic Elevators - Basis of Design: Vertical Express holeless twinpost telescopic hydraulic elevators.
- B. Hydraulic Elevators - Other Acceptable Manufacturers:
1. Otis Elevator Company; -: www.otis.com.
 2. Schindler Elevator Corporation: www.us.schindler.com.
 3. ThyssenKrupp Elevator; -: www.thyssenkruppelevator.com.

2.02 HYDRAULIC ELEVATORS

- A. Hydraulic Passenger Elevator, Type 1:
1. Hydraulic Elevator Equipment:
 - a. Holeless hydraulic with cylinder mounted within hoistway.
 2. Drive System:
 - a. Variable voltage variable frequency (VVVF) to modulate motor speed.
 3. Operation Control Type:
 - a. Two-Car Selective Collective Automatic (Duplex Collective Automatic) Operation Control.
 4. Interior Car Height: 96 inch (2438 mm).
 5. Electrical Power: 208 volts; alternating current (AC); three phase; 60 Hz.
 6. Rated Net Capacity: 2500 lbs (1135 kgs).
 7. Rated Speed: 125 to 150 ft per minute (0.63 to 0.75 m per second).
 8. Interior Car Platform Size: 80 inch wide by 51-1/2 inch deep (2032 mm wide by 1308 mm deep).
 9. Elevator Pit Depth: 48 inch (1219 mm).
 10. Overhead Clearance at Top Floor: 160 inch (____ mm).
 11. Travel Distance: As indicated on drawings.
 12. Number of Stops: As indicated on drawings.
 13. Number of Openings: 4 Front.
- B. Hydraulic Passenger Elevator, Type 2:
1. Hydraulic Elevator Equipment:
 - a. Holeless hydraulic with cylinder mounted within hoistway.
 2. Drive System:
 - a. Variable voltage variable frequency (VVVF) to modulate motor speed.
 3. Operation Control Type:
 - a. Two-Car Selective Collective Automatic (Duplex Collective Automatic) Operation Control.
 4. Service Control Type: Provide standard service control for elevator, in addition to the following.
 5. Interior Car Height: 96 inch (2438 mm).
 6. Electrical Power: 208 volts; alternating current (AC); three phase; 60 Hz.
 7. Rated Net Capacity: 3500 lbs (1590 kgs).
 8. Rated Speed: 125 to 150 ft per minute (0.63 to 0.75 m per second).
 9. Interior Car Platform Size: 80 inch wide by 65 inch deep (2032 mm wide by 1651 mm deep).
 10. Elevator Pit Depth: 48 inch (1219 mm).
 11. Overhead Clearance at Top Floor: 160 inch (____ mm).
 12. Travel Distance: As indicated on drawings.
 13. Number of Stops: As indicated on drawings.
 14. Number of Openings: 4 Front.

2.03 COMPONENTS

- A. Elevator Equipment:
 - 1. Motors, Hydraulic Equipment, Controllers, Controls, Buttons, Wiring, Devices, and Indicators: Comply with NFPA 70.
 - 2. Guide Rails, Cables, Buffers, Attachment Brackets and Anchors: Design criteria for components includes safety factors in accordance with applicable requirements of Elevator Code; ASME A17.1.
 - 3. Buffers:
 - a. Spring type for elevators with speed less than 200 ft per minute (1 m per second).
 - 4. Lubrication Equipment:
 - a. Provide grease fittings for periodic lubrication of bearings.
 - b. Grease Cups: Automatic feed type.
 - c. Lubrication Points: Visible and easily accessible.
- B. Electrical Equipment:
 - 1. Motors: NEMA MG 1.
 - 2. Boxes, Conduit, Wiring, and Devices: As required by NFPA 70.
 - 3. Spare Conductors: Include 10 percent extra conductors and two pairs of shielded audio cables in traveling cables.
 - 4. Include wiring and connections to elevator devices remote from hoistway and between elevator machine rooms. Provide additional components and wiring to suit machine room layout.

2.04 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with ASME A17.1, applicable local codes, and authorities having jurisdiction (AHJ).
- B. Accessibility Requirements: Comply with ADA Standards.
- C. Perform structural steel design, fabrication, and installation in accordance with AISC 360.
- D. Perform welding of steel in accordance with AWS D1.1/D1.1M.
- E. Fabricate and install door and frame assemblies in accordance with NFPA 80 and in compliance with requirements of authorities having jurisdiction.
- F. Perform electrical work in accordance with NFPA 70.

2.05 MATERIALS

2.06 OPERATION CONTROLS

- A. Elevator Controls: Provide landing operating panels and landing indicator panels.
 - 1. Landing Operating Panels: Metallic type, one for originating "Up" and one for originating "Down" calls, one button only at terminating landings; with illuminating indicators.
 - 2. Landing Indicator Panels: Illuminating.
 - 3. Comply with ADA Standards for elevator controls.
- B. Interconnect elevator control system with building security, fire alarm, card access, smoke alarm, and building management control systems.
- C. Door Operation Controls:
 - 1. Program door control to open doors automatically when car arrives at floor landing.
 - 2. Render "Door Close" button inoperative when car is standing at dispatch landing with doors open.
 - 3. Door Safety Devices: Moveable, retractable safety edges, quiet in operation; equipped with photo-electric light rays.
- D. Provide "Firefighter's Emergency Operation" in accordance with ASME A17.1, applicable building codes, and authorities having jurisdiction (AHJ).
 - 1. Designated Landing: Main Lobby.

2.07 OPERATION CONTROL TYPE

- A. Two-Car Selective Collective Automatic (Duplex Collective Automatic) Operation Control:
Applies to cars in two elevator shafts .
1. Park one car at main floor and designate other as free car, at landing last served or at a predetermined upper floor landing.
 2. Arrange free car to answer landing calls either above or below landing where car is standing except main floor landing calls.
 3. When free car is answering calls, automatically start an alternate car to answer landing calls under any of the following conditions:
 - a. Registration of up calls from landings below the free car while it is traveling up by alternate car below.
 - b. Registration of up or down calls from landings above the free car while it is traveling down by alternate car.
 - c. Free car fails to clear registered landing calls within 40 seconds, or to move alternate car in response to registered landing calls within this time frame.
 4. Register and answer calls by momentary pressure on one or more car buttons; cause car to respond.
 5. Once started, either in response to car button calls, or to landing button calls, respond to calls registered for the direction of the traveling car in the order that landings are reached, regardless of sequence that calls were registered.
 6. Allow only one car to stop in response to any one landing call.
 7. Return first free car to main floor after answering landing calls.
 8. Should both cars finish their calls at main floor, designate one car as the free car.
 9. If no car buttons are pressed and car starts up in response to several landing down calls, proceed first to the highest landing down call, then reverse to collect other landing down calls. Collect up calls similarly when car starts down in response to such calls.
 10. If a car stops for a landing call, and car button matching direction the car was traveling is pressed within a predetermined time interval after a landing stop, proceed in the same direction regardless of other landing calls that are registered.
 11. If down landing buttons are pressed while car is traveling up, do not stop at those landings but allow those calls to remain registered for answering by the next down traveling car.
 12. After the highest car has responded to up landing calls, reverse car automatically and respond to down landing calls.
 13. When traveling down, a car will not respond to up calls. Allow those up calls to remain registered to be answered by next available car on an up trip.
 14. Include a time delay to hold car for an adjustable time interval at landings where stops are made to enable passengers to enter or leave the car. Cancel the time interval upon registration of a car call or pressure on the car door close button.
 15. Permit a registered car call to establish the direction of travel when a car has answered the farthest car call, even if other landing calls are registered.
 16. Answer calls to the basement landing with the car that is normally parked at the main floor unless the free car is at the basement.
 17. If a car is removed from service, the other car shall answer landing calls.

2.08 HOISTWAY ENTRANCES

- A. Hoistway Entrances; Each Floor Elevator Landing:
1. Framed Opening Material and Finish: Brushed stainless steel.
 2. Door Material and Finish: Brushed stainless steel.
 3. Hoistway Fire Rating: 2 Hours.
 4. Door Fire Rating: 1-1/2 Hours.
 5. Sills: Extruded aluminum.
- B. Car Doors:
1. Car Door Material and Finish: To match the hoistway entrance doors.

2. Car Doors: 18 gage, 0.0478 inch (1.21 mm) minimum sheet thickness, rigid sandwich panel construction.
3. Sills: Extruded aluminum.
- C. Hoistway Entrances and Car Doors:
 1. Width: 42 inch (1.067 m).
 2. Height: 84 inch (2.134 m).
 3. Door Type: Single leaf.
 4. Door Operation: Side Opening, single speed.
- D. Thresholds: Form to align with frame return and coordinate with floor finish.
- E. Gasketing: Provide acoustical type gasketing at hoistway doors and frames to eliminate audible noise due to car activities in the hoistway, and air pressure differential between hoistway and landing floors.

2.09 CAR FINISH MATERIALS

- A. Car Operating Panel: Provide main and auxiliary; flush-mounted applied face plate, with illuminated call buttons corresponding to floors served, alarm button, and "Door Open" button.
 1. Position alarm button where it is unlikely to be accidentally actuated; not more than 54 inch (1372 mm) above car finished floor.
- B. Comply with ADA Standards for operating panel and interior layout of car.
- C. Stainless Steel Hand Rail: Round, 1-1/2 inch (38 mm) diameter, with No. 4 Brushed finish.
- D. Rails: Provide 1-1/2 inch (38 mm) clearance space from wall.
- E. Ceiling System: Type Particle board downlight ceiling with LED lighting and stainless steel panel finish by Vertical Express.
- F. Tile Flooring: As indicated on the drawings.
- G. Plastic Laminate Wall Panel: NEMA LD 3, Type HGS, color as selected by Architect from manufacturer's standard line of colors.
- H. Wall Panel Reveal: Brushed stainless steel
- I. Emergency Lighting: Comply with ASME A17.1 elevator lighting requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting this work.
- B. Verify that hoistway, pit, and machine room are ready for work of this section.
- C. Verify hoistway shaft and openings are of correct size and within tolerance.
- D. Verify location and size of machine foundation and position of machine foundation bolts.
- E. Verify that electrical power is available and of correct characteristics.

3.02 PREPARATION

- A. Arrange for temporary electrical power for installation work and testing of elevator components. Comply with requirements of Section 01 5000.
- B. Maintain elevator pit excavation free of water.

3.03 INSTALLATION

- A. Coordinate this work with installation of hoistway wall construction.
- B. Install system components, and connect equipment to building utilities.
- C. Provide conduit, electrical boxes, wiring, and accessories.
- D. Install hydraulic piping between cylinder and pump unit.
- E. Mount machines, motors, and pumps on vibration and acoustic isolators, on bed plate and concrete pad.
 1. Securely fasten to building supports.

- 2. Prevent lateral displacement.
- F. Size hoistway and machine room in accordance with approved shop drawings.
- G. Install guide rails to allow for thermal expansion and contraction movement of guide rails.
- H. Accurately machine and align guide rails, forming smooth joints with machined splice plates.
- I. Install hoistway door sills, frames, and headers in hoistway walls; grout sills in place, set hoistway floor entrances in alignment with car openings, and align plumb with hoistway.
- J. Structural Metal Surfaces: Clean surfaces of rust, oil or grease; wipe clean with solvent; prime two coats.
- K. Adjust equipment for smooth and quiet operation.

3.04 ERECTION TOLERANCES

- A. Guide Rail Alignment: Plumb and parallel to each other in accordance with ASME A17.1 and ASME A17.2.
- B. Car Movement on Aligned Guide Rails: Smooth movement, without any objectionable lateral or oscillating movement or vibration.

3.05 ADJUSTING

- A. Adjust for smooth acceleration and deceleration of car so not to cause passenger discomfort.
- B. Adjust with automatic floor leveling feature at each floor landing to reach 1/4 inch (6.4 mm) maximum from flush with sill.

3.06 CLEANING

- A. Remove protective coverings from finished surfaces.
- B. Clean surfaces and components and make ready for inspection.

3.07 CLOSEOUT ACTIVITIES

- A. See Section 01 7800 - Closeout Submittals, for closeout submittals.
- B. See Section 01 7900 - Demonstration and Training, for additional requirements.
- C. Demonstrate proper operation of equipment to Owner's designated representative.

3.08 PROTECTION

- A. Do not permit construction traffic within car after cleaning.
- B. Protect installed products until Date of Substantial Completion.
- C. Touch-up, repair, or replace damaged products and materials prior to Date of Substantial Completion.

3.09 MAINTENANCE

- A. Provide Initial Maintenance Contract of elevator system and components in accordance with ASME A17.1 and requirements as indicated for 12 months from Date of Substantial Completion.
- B. Perform maintenance contract services using competent and qualified personnel under the supervision and direct employ of the elevator manufacturer or installer.
- C. Include systematic examination, adjustment, and lubrication of elevator equipment. Maintain and repair or replace parts whenever required using parts produced by the original equipment manufacturer.
- D. Perform work without removing cars from use during peak traffic periods.

END OF SECTION

SECTION 14 9100
FACILITY CHUTES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Gravity chutes for soiled linen.

1.02 RELATED REQUIREMENTS

- A. Section 06 1000 - Rough Carpentry: Wood curb at roof vent.
- B. Section 07 5300 - Elastomeric Membrane Roofing: Cants and roofing flashing at chute roof vent.
- C. Section 07 6200 - Sheet Metal Flashing and Trim: Counterflashing at chute roof vent.
- D. Section 07 8400 - Firestopping.
- E. Section 21 1300 - Fire Suppression Sprinklers: Connection to sprinklers inside chute.
- F. Section 28 3100 - Fire Detection and Alarm: Connection of interlock systems and sensors to fire alarm system.

1.03 REFERENCE STANDARDS

- A. NFPA 13 - Standard for the Installation of Sprinkler Systems; 2016.
- B. NFPA 82 - Standard on Incinerators and Waste and Linen Handling Systems and Equipment; 2014.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene 7 days before start of installation to review code requirements, manufacturer's recommendations, and related work.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for additional requirements.
- B. Product Data: Manufacturer's printed data sheets on each component, indicating which options are provided.
- C. Shop Drawings: Detailed layout of chute and components, indicating interface with structure, enclosing walls, and utilities; show:
 - 1. Openings in floors and required clearances.
 - 2. Location and size of each field connection to structure.
 - 3. Electrical wiring sizes, conduits, and location of connections.
 - 4. Clearly indicate components required but not furnished by chute installer.
- D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 6000 - Product Requirements, for additional provisions.
 - 2. Laundry Bags: Cotton dacron with sufficient strength to withstand impact at discharge hopper without bursting.
 - a. Maximum Weight When Full: 40 pounds.
 - b. Size: As required so does not jam inside chute when full.
 - c. Provide 20 bags.
 - d. Include purchasing source for bags.
 - 3. Sanitizing Solution or Chemicals for Cleaning Chute: 2 gallons (8 liters).

1.06 QUALITY ASSURANCE

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Products Requiring Electrical Connection: Listed and classified by UL as suitable for the purpose specified and indicated.
- C. Manufacturer Qualifications: Company specializing in making products specified in this section.
 - 1. With not less than 5 years of experience.
 - 2. With similar installation in satisfactory service for at least one year.

- D. Installer Qualifications: Company specializing in performing the work of this section:
1. Approved by manufacturer.

1.07 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional requirements.
- B. Correct defective work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Chutes and Chute Components:
1. CHUTES International; -: www.chutes.com.
 2. Wilkinson-Hi-Rise LLC; -: www.whrise.com.
 3. U. S. Chutes Inc.; -: www.uschutes.com.
 4. Valiant Products, Inc.; -: www.valiantproductsinc.com.
 5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 CHUTES

- A. Linen Chutes: Sheet metal, round, constant diameter extending from above roof to lowest floor with intake doors at each floor and bottom outlet into room designated on drawings; complying with requirements of NFPA 82 and local code.
1. Diameter: 24 inches (610 mm) inside.
 2. Intake Doors: Side-hinged, no locks.
 3. Intake Door Size: 21 by 21 inches (530 by 530 mm) wide by high.
 4. Intake Door Operator: Foot pedal that unlatches and opens door.
 5. Interlock system and sensors that automatically prevents:
 - a. Opening more than one intake door at a time.

2.03 COMPONENTS

- A. Chute: Factory-fabricated to the greatest extent possible, with continuously welded or lock-seamed joints and smooth, non-snag interior (no protruding bolts, rivets, hardware, sharp edges or corners).
1. Material: Stainless steel sheet.
 2. Sheet Metal Thickness: 16 gage, 0.06 inch (1.5 mm).
 3. Throat Sections: Provide sloped throat sections for intake doors, of same material and construction as chute.
 4. Factory-coat outside of chute with sprayed sound-dampening material.
 5. Fabricate with support frames at each floor with sound isolator pads and expansion joints in chute between each support point.
- B. Intake Doors: Factory-assembled door and frame, self-closing and positive-latching; frame designed for chase construction, flush-mounted.
1. Material: Stainless steel, brushed or satin finish.
 2. Fire Rating: 1-1/2 hour ("B" label) with 30-minute temperature rise of 250 degrees F (121 degrees C).
 3. Side-Hinged Doors: Right-hand swing unless otherwise indicated; 180 degree swing.
 4. Pulls: T-handle or lever handle latch; polished stainless steel.
 5. Signs: Mark on frame or door face the purpose of the chute, using engraving, integral raised lettering, or other permanent signs.
- C. Discharge Doors: Aluminum-coated or stainless steel; normally-open, 1 1/2-hour ("B" label) fire rated, with fusible link closing; style as required by chute configuration.
- D. Access Doors: Same construction and fire rating as intake doors, with locks; provide wherever equipment requiring maintenance is located inside chute, including sprinklers and plumbing and electrical connections.
- E. Roof Vent: Full diameter, extending minimum 48 inches (1220 mm) above roof level, with roof deck flange.

1. Material: Manufacturer's standard.
 2. Counterflashing and clamping ring of non-ferrous metal compatible with chute material.
 3. Top Unit: Screened vent.
- F. Fire Sprinklers: Comply with NFPA 82 and NFPA 13, refer to Section 21 1300; provide 1/2 inch NPS (15 DN) sprinkler heads mounted inside chute intake throats at following locations:
1. At or above the top intake opening.
 2. At the lowest intake opening.
 3. In buildings of more than two stories, at every other floor.
- G. Electrical Controls: 110 V AC.

PART 3 EXECUTION

3.01 COORDINATION

- A. Complete chute installation and testing before completion of enclosing construction.
- B. Coordinate sprinkler and spray cleaning devices with size, location and installation of service utilities.
- C. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

3.02 INSTALLATION

- A. Install chutes and equipment in accordance with NFPA 82 requirements and manufacturer's instructions.
- B. Maintain fire-resistive capacity of enclosing walls.
- C. Install chute plumb and without offsets or obstructions that might prevent free fall of materials, except where indicated on drawings.
- D. Anchor securely in manner required to withstand impact and weight of materials in chute.
- E. Install roof vent flange to roof deck prior to installation of roofing.
- F. Install counterflashing after roofing installation.
- G. Adjust doors and other operating components for smooth operation.

3.03 CLEANING

- A. After completion of enclosing walls, clean exposed chute components; do not remove testing agency labels.

END OF SECTION

SECTION 21 1313

FIRE PROTECTION SYSTEMS

PART 1 – GENERAL

1.01 SCOPE

- A. Furnish and install an automatic fire sprinkler system in accordance with NFPA #13R and a manual wet standpipe system in accordance with NFPA #14 to protect all areas of the new Home 2 Suites at Trinity Center building as indicated herein and as shown on the drawings. Connect system to a water supply of sufficient pressure to ensure full and sustained water discharge immediately from sprinkler heads when opened by fire at rated heat temperatures. Water supply shall conform to NFPA water supply requirements with considerations given to the reliability of the public water supply, taking into account probable minimum pressure conditions. The water supply characteristics for sprinkler system design at the point of the new water service connection to the existing water main are as follows as provided by the City of Helena: 31 PSI static, 17 PSI residual with 1,363 GPM flowing. A fire booster pump installed in accordance with NFPA #13 will be required based on future low pressure zone as directed by City of Helena. Current static pressure is 104 PSI and fire booster pump should be sized so that static pressure does not exceed 175 PSI.
- B. All portions of the systems shall be installed in accordance with the drawings, details, and specifications and as required by jurisdictional authorities and codes. The position is taken that the Owner is entitled to a project which meets or exceeds the minimum requirements of nationally recognized fire protection standards. All efforts and installations shall be directed toward this end. Where there is conflict between the contract drawings and/or specifications, and the requirements of the jurisdictional authorities or codes, the conflict shall be brought to the attention of the Engineer at least ten (10) days prior to bidding or be resolved at no cost to the Owner. If the contractor has not identified conflicts to the Engineer, he shall be responsible for complying with the most restrictive (expensive) methods.
- C. The intent of these specifications is to describe the complete systems to be installed, including minor details of work or materials not specifically mentioned or shown on the drawings, but necessary for the successful operation and completion of the installation. Contractor shall provide all minor details of work or materials necessary for a complete system even if not specifically mentioned or shown on the drawings. This includes any fittings, offsets, valves, drains, hangers, bracing or piping that may be necessary due to field conditions or coordination with other trades.
- D. Work to be performed under this section shall include, but not be limited to the following:
 - 1. Automatic Wet Pipe Fire Sprinkler System.
 - a. Pipe and fittings.
 - b. Hangers and supports.
 - c. Earthquake bracing.
 - d. Valves.
 - e. Alarms.
 - f. Flow and Tamper Switches.

- g. Specialties.
 - 2. Manual Wet Class I Standpipe System.
 - a. Pipe and fittings.
 - b. Hangers and supports.
 - c. Earthquake bracing.
 - d. Valves.
 - e. Alarms.
 - f. Flow and Tamper Switches.
 - g. Specialties
 - 3. Fire Pump System.
 - a. Pipe and fittings.
 - b. Hangers and supports.
 - c. Earthquake bracing.
 - d. Valves.
 - e. Alarms.
 - f. Flow and Tamper Switches.
 - g. Pressure maintenance pump.
 - h. Flow metering device.
 - i. Circulation relief valve.
 - j. Automatic air release valve
 - k. Hose valves.
- E. Furnish and install an automatic fire protection system of type or types required in the following areas:
- 1. All interior areas of the building – Automatic Wet Pipe Fire Sprinkler system.
 - 2. All required exit stairways – Manual Wet Class I Standpipe system.
 - 3. On sprinkler system supply – Fire Pump system.

1.02 RELATED WORK

- A. All work performed under this section of the specifications shall be subject to the requirements of both the General and Special Conditions.
- B. Related work specified elsewhere:
 - 1. Section 262230 - Fire Detection and Alarm System
- C. Examine the above referenced specification parts thoroughly before submitting a proposal for accomplishment of work in this section.

1.03 REGULATORY AGENCIES

- A. The term jurisdictional authority used in this section of the specification shall include, as applicable, but not be limited to the following:
 - 1. City of Helena Building Department.
 - 2. City of Helena Fire Marshall.
 - 3. Owner.
- B. The design and installation of all systems of fire protection shall conform to all requirements of applicable codes and publications herein defined:
 - 1. International Building Code (2012)
 - 2. International Fire Code (2012)
 - 3. NFPA #13 (2010)
 - 4. NFPA #13R (2010)
 - 5. NFPA #14 (2010)
 - 6. NFPA #20 (2010)
 - 7. All State and local ordinances
 - 8. Home2 Suites By Hilton Brand Standards (August 01, 2015)
 - 9. Underwriters' Laboratories
 - 10. American Society of Testing Materials
 - 11. American National Standards Institute
 - 12. Occupational Safety and Health Administration

1.04 SUBMITTALS

- A. General
 - 1. The successful Contractor shall provide submittal data as required under other portions of this specification.
 - 2. Work on the project shall not begin until submittals have been accepted by the Authority Having Jurisdiction and the Engineer.
- B. Working Plans
 - 1. Submit working plans (floor plans - detailed working drawings), showing dimensions, ducts, lights, or other items affecting the fire protection systems to jurisdictional agencies for review and approval. All items identified in NFPA #13 for proper working plans shall be complied with. After approvals from jurisdictional agencies have been returned to the Contractor, they will be submitted to the Engineer for final review and approval.
 - 2. Working plans shall be prepared in AutoCAD or compatible software.
- C. Catalog/Product Information

1. Product data on all materials intended for use and as indicated on the drawings shall be submitted to the jurisdictional agencies and Engineer for approval. Product data submittals shall clearly indicate the proposed product to be used and include an index of all materials.

D. Hydraulic Calculations

1. Hydraulic calculations shall be submitted to the Authority Having Jurisdiction and Engineer for approval. Calculations shall be provided to substantiate all the pipe sizes shown on the working plans.

E. Installer's Qualifications

1. All systems of fire protection shall be installed by a licensed (for the location of installation) Fire Protection Contractor, fully experienced in fire protection installation as required and specified herein.
2. All installers shall be competent and shall hold an endorsement by the State of Montana. Prior to beginning work, current Contractor's and Installer's license and endorsements shall be on file with the Department of Commerce Professional and Occupational Licensing Bureau (301 South Park, P.O. Box 200513, Helena, MT 59620-0513)
3. Fire Protection Contractors may be required to provide in writing specific information as to successfully completed projects and references to show cause as to why they should be considered acceptable to the Engineer.

F. Close-Out

1. Record Drawings required per paragraph 1.6 and Operation and Maintenance Manuals required per paragraph 1.7, shall be submitted to the Engineer for approval at the completion of the project.

1.05 JOB CONDITIONS

- A. The Contractor shall investigate the structural, mechanical, electrical, and finished conditions affecting the piping, and shall arrange the equipment accordingly; furnishing required fittings, offsets and accessories. Route fire protection piping to avoid interference with duct work and drain piping. In the event it becomes necessary to make field changes in pipe locations due to building construction, the Contractor shall consult with the system designer before making any changes. Any such changes required shall be made without added cost to the Owner.
- B. The Contractor shall determine, and be responsible for, the proper locations and type of inserts for hangers, chases, sleeves, and other openings in the construction required for fire protection work, and shall obtain this information well in advance of the construction progress to avoid delay of the work.
- C. Contractor is responsible for final locations of sprinklers and routing of piping and shall be responsible for coordinating with other trades on site prior to system installation. Contractor shall review all contract documents including architectural, structural, mechanical, electrical, etc. for actual contract conditions.
- D. All fees and permits specifically required for fire protection work, not obtained by others as specified elsewhere shall be applied for and paid for by this Contractor.

1.06 RECORD DRAWINGS

- A. One approved set of working plans shall be maintained on the job at all times.
- B. One set of “As-Built” of the working plans and contract drawings shall be kept on the job at all times. “As-Built” drawings shall be kept current daily. “As-Built” drawings shall be available at all times to Engineer for review and use.
- C. One reproducible set of “As-Built” drawings and AutoCAD drawing files of the “As-Built” drawings shall be provided upon completion of the work.

1.07 OPERATION AND MAINTENANCE MANUALS

- A. Three (3) final sets of operating and maintenance instructions shall be provided to the Owner upon completion. Manuals shall include, as a minimum, the following:
 - 1. “As-Built” Drawings
 - 2. Catalog cut sheets of all materials installed
 - 3. Equipment maintenance manuals
 - 4. Hydraulic Calculations
 - 5. Acceptance Test Certificate
 - 6. Certification of Owner Training
 - 7. Contractor Guarantee and Warranty
 - 8. “As-Built” AutoCAD drawing (.dwg) file or equal on CD
- B. One (1) original copy of NFPA #25 (2008) shall be provided to the Owner.
- C. Operation and Maintenance Manuals shall be submitted to the Engineer for approval within 14 days after final testing.

1.08 TRAINING

- A. The Fire Protection Contractor shall instruct the Owner in the operation of the systems. Instruction shall continue until the Owner is fully satisfied that he understands the operation of his system.
- B. Contractor shall obtain Owner’s dated signature that all training has been accomplished and is acceptable to the Owner.

1.09 GUARANTEES AND WARRANTIES

- A. The Fire Protection Contractor shall guarantee to the Owner in writing, all equipment and workmanship for a period of one (1) year after the fire protection system has been placed in continuous service and has been accepted by all authorities having jurisdiction.
- B. The Fire Protection Contractor shall not be held responsible for improper or negligent maintenance by the Owner after operating and maintenance indoctrination has been given to the Owner.

PART 2 - PRODUCTS

2.01 FIRE SPRINKLER SYSTEM EQUIPMENT

- A. Where contract documents indicate specific model number or manufacturer; Contractor may substitute identical equipment approved for fire protection use.

2.02 AUTOMATIC SPRINKLERS

- A. All sprinklers shall be of similar design and from a single manufacturer.
- B. The operating temperature of sprinklers shall be as required by the specific location of installation in accordance with NFPA #13 requirements.
- C. Sprinklers shall conform to the following schedule:
 - 1. Brass upright or pendent sprinklers may be used in all attic, mechanical, storage or other non-public spaces or areas where piping is exposed.
 - 2. White pendent sprinklers with white recessed escutcheons shall be used in the following locations; Public spaces not within dimming zone 1, guestroom corridors, guestrooms.
 - 3. Brass pendent sprinklers with white concealed cover plates shall be used in the following locations; Public spaces within the dimming zone 1, elevator lobbies.
 - 4. Chrome pendent or sidewall sprinklers with chrome recessed escutcheons shall be used in the pool area.
 - 5. All sprinklers shall be quick-response type. Residential type sprinklers may be used where allowed by NFPA #13R.
 - 6. Sprinklers in housekeeping areas shall include wire head guards listed for the sprinklers on which they are installed.
- D. Manufacturers
 - 1. Tyco
 - 2. Victaulic
 - 3. Viking
 - 4. Reliable

2.03 PIPE AND FITTINGS

- A. Interior piping for automatic sprinkler system shall conform to NFPA #13 and as follows.
- B. Sprinkler piping with threaded fittings shall be Schedule 40, Dyna-Thread or equal black steel pipe.
- C. Fittings for threaded and coupled pipe shall consist of cast iron or ductile threaded fittings joined with Teflon tape thread sealing compound or pipe joint compound. Pressure rating of fittings shall be as required for application.

- D. Sprinkler piping for sizes 2½" and larger may be Schedule 10, Dyna-Flow or equal black steel pipe with grooved fittings.
- E. Fittings for grooved end pipe shall consist of Tyco Grinnell Series or equal couplings and fittings in accordance with NFPA #13.
- F. CPVC piping with solvent weld fittings may be used when installed in accordance with the U.L. listing requirements and manufacturer's recommendations.
- G. Fittings for plain end pipe shall not be used.
- H. Flexible piping drops that are U.L. listed or FM approved shall be used where sprinkler heads are installed in suspended acoustical tile ceilings. Flexible piping drops shall use braided stainless steel hose or braided stainless steel hose cover.
- I. All drain and fire department connection piping and fittings down-stream of valves shall be galvanized. Malleable iron fittings are acceptable.

2.04 HANGERS AND SUPPORTS

- A. Space pipe hangers in accord with the requirements of NFPA #13. Construct hangers, hanger rods, inserts and clamps as approved by the same.
- B. Manufacturers:
 - 1. Tolco
 - 2. Afcon
 - 3. Erico
 - 4. Speedy Product (Super Screws)
 - 5. Elco (Hanger Mate)
- C. Concrete hanger inserts shall be approved for use in Seismic Design Category C or D.

2.05 EARTHQUAKE BRACING

- A. Furnish and install all earthquake bracing and restraint as required by International Building Code, NFPA #13 and the authority having jurisdiction.
- B. Bracing attachments shall be made to the top chord of open web steel bar joists, steel I-beams, wood beams or concrete decking.
- C. Concrete insert attachments used for seismic bracing shall be approved for use in Seismic Design Category C or D.
- D. Calculations shall be provided with the working plans to indicate the zone of influence for the seismic braces, bracing attachments to pipe and attachment to structure in accordance with NFPA #13.

2.06 VALVES

- A. Gate valves shall be approved indicating type as required by NFPA #13 or NFPA #14. Check valves shall be as required by NFPA #13 or NFPA #14. Test and drain valves shall be approved brass globe, angle, or ball valves. Locate sprinkler system isolation valves as shown on the drawings complete with a tamper alarm.
- B. Interior
 - 1. Gate
 - a. Make: Nibco
 - b. Sizes: 2½" through 6"
 - c. Ends: Flanged
 - d. Model: F-607-OTS
 - 2. Butterfly
 - a. Make: Tyco
 - b. Sizes: 2½" through 6"
 - c. Ends: Grooved
 - d. Model: BFV-1
 - e. Note: Butterfly valves may be used in lieu of OS&Y valves at the Contractor's option for 2½" and larger valves.
 - 3. Ball Valve
 - a. Make: Tyco
 - b. Sizes: ¼" through 2"
 - c. Ends: Threaded
 - d. Model: F19
 - 4. Check Valve
 - a. Make: Tyco
 - b. Sizes: 2½" through 4"
 - c. Ends: Grooved
 - d. Model: CV-1F
 - 5. Drain Valve
 - a. Make: Nibco
 - b. Sizes: ½" through 1"
 - c. Ends: Threaded
 - d. Model: KT-65-UL
 - 6. Test N Drain Valve
 - a. Make: AGF

- b. Sizes: 1" through 2"
 - c. Ends: Threaded
 - d. Model: 1011, 1000, and 1011T
- C. All control valves and drain valves shall be installed within six feet of the floor level for maintenance access.
- D. Manufacturers:
 - 1. Tyco
 - 2. Nico
 - 3. AGF
 - 4. Victaulic
 - 5. Reliable
 - 6. Mueller
 - 7. United Brass

2.07 STANDPIPES

- A. Provide Manual Wet Class I standpipes in each of the required exit stairways as required by NFPA #14.
- B. Provide 2½" hose valves with 2½" NPT female inlet and 2½" male NSHT outlet complete with 2½"x 1½" hose thread reducer and 1½" cap and chain. Finish shall be polished chrome.
- C. Hose valves shall be installed 4'-0" above floor at stair landings.
- D. Provide 4"x2½"x2½" roof manifold on the roof at each stair that does not continue to the roof level. Each roof manifold to have two hose valves and accessories as indicated above. Install water pressure gauge at each roof manifold. Finish shall be polished chrome.
- E. Provide NRS gate valve with post indicator valve on roof and tamper switch supervised normally closed for control of roof manifold.

2.08 BACKFLOW PREVENTION DEVICES

- A. Install new reduced pressure type backflow prevention devices as required by the Water Authority having jurisdiction.
- B. Devices shall be UL or FM approved.
- C. All reduced pressure backflow prevention devices shall be provided with an air gap drain with splash guard and piped to the exterior or adequate floor drain with galvanized pipe and fittings.
- D. Backflow prevention device shall be tested and certified by the installing contractor.

E. Manufacturers:

1. Febco
2. Ames
3. Watts

2.09 FIRE DEPARTMENT CONNECTIONS

- A. Furnish and install where approved by authority having jurisdiction fire department connections, complete with clapper, plugs and chains.
- B. Fire department connection shall have three 2½" inlets to supply the standpipe demand. Connection shall be flush type.
- C. Fire department connections shall be set 2'-6" above grade.
- D. Fire department connections identification plate shall be indexed "AUTO. SPKR. STANDPIPE". The indexing shall be "cast in" by the manufacturer. Required indexing shall be permanently installed at the connection.
- E. Fire department connection shall be complete with interior independent self-closing clappers at each inlet, plugs and shall have threads to meet the local fire department requirements. Finish of all exposed portions of the fire department connection on the exterior shall be polished chrome.
- F. Provide an automatic ball-drip drain at low point of piping between the fire department inlet connection and check valve.
- G. Manufacturers:
 1. Potter Roemer
 2. Croker
 3. Powhatan
 4. Tyco

2.010 SPECIALTIES

- A. Fire Seals
 1. Where piping passes through walls, floors or other building construction which by code requires a fire rating, approved fire rated assemblies shall be used. Proposed protection shall be submitted for approval. Review Architectural plans for locations of fire rated construction.
- B. Escutcheon Plates
 1. Where approved exposed piping passes through finish work, chrome plated (or other finish acceptable to the Architect or Engineer) wall plates shall be installed. Split wall plates or escutcheons shall be installed to fit snugly around piping. All wall plates shall be metal.
 2. Solid galvanized wall plates shall be used at both sides of all exterior walls where piping passes through the exterior wall.

C. Valve Identification

1. All valves within the building shall have permanently marked identification signs provided in accordance with NFPA #13 and NFPA #14 standards. Signs shall be manufactured and not hand written. Signs shall be hung with galvanized or chrome chain.

D. Spare Head Supply

1. Furnish and install a supply of extra sprinklers (minimum of two) of each type and degree link installed in the project, complete with mountable box. Mount box on wall next to fire sprinkler system riser. Provide wrenches for each type of sprinkler installed in box.

2.011 ELECTRICAL DEVICES

- A. All electrical devices shall be coordinated with Electrical and Fire Alarm requirements for compatibility of voltages and manufacturer.

B. Flow Switch

1. Potter VSR-F
2. Potter VSR-SF

C. Tamper Switch

1. Potter OSYSU-2
2. Potter RBVS

D. Pressure Switch

1. Potter PS40-2
2. Potter PS10-2

E. Audio/Visual Alarm Indicating Appliances

1. Audio/Visual units shall provide a common enclosure for the fire alarm audible and visual alarm devices. The housing shall be designed to accommodate either horns, bells, or chimes. The unit shall be complete with a tamper resistant, Pyramidal shaped lens with "Fire" lettering visible from a 180° field of view. Integral Xenon strobe shall provide a minimum light output of 4.5 candelas at 24VDC at a 45 flashes per minute rate. Xenon strobes shall provide a 4-wire connection to insure properly supervised in/out system connection. Unit shall be complete with all mounting hardware including backbox.

F. Manufacturers:

1. Potter Signal
2. System Sensor

2.012 FIRE PUMPS GENERAL

- A. Fire pump shall be electric motor driven. Fire pump capacity shall be rated at 200 gpm with a rated net pressure of 50 psi. Fire pump shall furnish not less than 150 percent of rated flow capacity at not less than 65 percent of rated net pressure. Pump shall be centrifugal in-line fire pump. The

maximum rated pump speed shall be 3,535 rpm when driving the pump at rated capacity. Pump shall be automatic start and manual stop. Pump shall conform to the requirements of UL 448. Fire pump discharge and suction gauges shall be oil-filled type. Coordinate with electrical contractor for electrical characteristics of fire pump.

2.013 VERTICAL IN-LINE PUMP

- A. Casings shall be of cast iron having a minimum tensile strength of 35,000 P.S.I. Bearing housing supports, and suction and discharge flanges shall be integrally cast with the lower half of the casing. Removal of the upper half of the casing must allow the rotating element to be removed without disconnecting the suction and discharge flanges.
- B. Impellers shall be of the enclosed type and shall be of vacuum cast bronze. Impellers shall be dynamically balanced, keyed to the shaft, and held in place with threaded shaft sleeves.
- C. The pump shaft shall be made of SAE 1045 Steel or equal, accurately machined to give a true running rotating element. Shaft shall be protected by bronze sleeves which are key locked and threaded so that the sleeves tighten with the rotation of the shaft. A gasket shall seal between the impeller hub and the shaft sleeve to protect the pump shaft.
- D. Pump shall be equipped with renewable bronze casing rings so designed that hydraulic pressure will seat them against a shoulder in the pump case around the full periphery of the wearing ring. The wearing rings will be locked by doweling to prevent rotation. The rotating element uses heavy duty grease lubricated ball bearings and shall be equipped with water slingers. Bearing housings shall be so designed to flush lubricant through the bearing.
- E. All pumps where the suction pressure is expected to average 40 P.S.I. or below, shall be provided with a lantern ring connected to the pressure side of the pump by a cored passage in the parting flange of the pump. Stuffing boxes shall be equipped with split bronze packing glands designed for easy removal for packing inspection and maintenance.

2.014 ELECTRIC MOTOR DRIVER

- A. The design of the power supply to the electric drive fire pumps will comply with Chapter 6 of NFPA #20 and to NFPA #70. The fire pump power supply and fire pump power circuits and feeders will be indicated and detailed on the drawings.
- B. Power supply protective devices installed in the power supply circuits and in the fire pump feeder circuits will be designated not to open at the sum of the locked rotor currents (continuous) of the fire pump motor and any other maximum loads on the circuit per NFPA #20.
- C. Fire pump feeder circuit conductors will be physically routed outside of the building(s), excluding the electrical switchgear room and the fire pump room. When the fire pump feeder conductors must be routed through the buildings, they will be buried or enclosed by 50 mm (2 inches) of concrete or equivalent fire-rated construction.
- D. Designer shall indicate and detail the grounding of the controller per NFPA #20.
- E. Controllers and contactors shall have a maximum of 120-volt control circuits, and auxiliary contacts for use with controls furnished. When motors and equipment furnished are larger than sizes indicated, the cost of providing additional electrical service and related work shall be included under

this section. Motor shall conform to NEMA MG 1 and be marked as complying with NEMA Design B standards. Motor horsepower shall be of sufficient size so that the nameplate horsepower rating will not be exceeded throughout the entire published pump characteristic curve. The motor and fire pump controller shall be fully compatible.

- F. Motor shall conform to NEMA standards and have round frame; drip cover; Nema C face; joint Nema and Hydraulic Institute shaft extension.
- G. Motor electrical characteristics shall be Nema Design B suitable for full voltage starting: 3-phase; 60-cycle; 208 volts with full load speed as indicated under operating conditions.
- H. Motor enclosure shall be open drip proof type with Class B insulation, capable of carrying full load continuously in an ambient temperature of 40° C and shall have a 1.15 service factor.

2.015 CONTROLLERS

- A. Control equipment shall meet all requirements of NFPA #20.
- B. Control Equipment for Electric Drive
 - 1. The Fire Pump motor control shall be U.L. Listed and/or F.M. Approved, where applicable. It shall be completely assembled, wired and tested by the control manufacturer before shipment from the factory, and shall be labeled "Fire Pump Controller". The controller shall be located as close as practical and within sight of the motor. The controller shall be so located or protected that it will not be injured by water escaping from the pump or connections. The controller shall be of the combined manual and automatic, across the line type, and shall be complete with:
 - a. Disconnect switch - externally operable, quick-break type.
 - b. Circuit breaker - time delay type with trips in all phases set for 300% of the motor full-load current.
 - c. Motor starter - across-the-line type capable of being energized automatically through the pressure switch or manually by means of an externally operable handle.
 - d. Pressure switch set to cut in at 90 psi.
 - e. Running period timer - set to keep motor in operation, when started automatically, for a minimum period of one minute for each 10 HP motor rating, but not to exceed 7 minutes.
 - f. Pilot lamp - to indicate circuit breaker closed and power available.
 - g. Ammeter test link and voltmeter test studs.
 - h. Alarm relay - to energize an audible or visible alarm through an independent source of power to indicate circuit breaker open or power failure.
 - i. Manual selection station - a two-position station shall be provided on the enclosure marked "Automatic" and "Non-Automatic".
 - j. Means shall be provided on the Controller to operate an alarm signal continuously while the pump is running.

2.016PRESSURE MAINTENANCE PUMP

- A. The pressure maintenance pump shall be sized as not to exceed 175 psi static pressure. Coordinate with electrical contractor for electrical characteristics of pump.
- B. The pump shall have the approximately the following minimum characteristics:
 - 1. Volume: 4 gpm
 - 2. Pressure: 50 psi
 - 3. Pump RPM: 3,500 rpm
 - 4. Intake Diameter: 1 inch
 - 5. Discharge Diameter: 1 inch
- C. The pressure maintenance pump shall maintain pressure on system downstream from the pump discharge manifold and compensate for minor system losses. The pump shall take suction from the fire pump intake manifold.
- D. An approved indicating gate valve of the outside screw and yoke (OS&Y) or butterfly type shall be provided in the maintenance pump discharge and suction piping.
- E. An oil-filled water pressure gauge and approved check valve in the maintenance pump discharge piping shall be provided. Check valve shall be swing type with removable inspection plate.

2.017PRESSURE MAINTENANCE PUMP CONTROLLERS

- A. The Pressure Maintenance Pump Controller shall be listed by Underwriters Laboratories for industrial control. The controller shall be completely factory wired, assembled and tested prior to shipment. The controller shall be housed in a NEMA Type-2 General purpose - indoors enclosure fabricated from heavy gauge cold rolled steel per the requirements of UL 508.
- B. A fusible disconnect switch, with fuses, shall be provided and sized for at least 115 percent of motor full load current. The disconnect switch shall be operated by an externally mounted handle. This handle shall be interlocked with the enclosure door to prevent the opening of the controller door while the switch is in the ON position except by means of a hidden defeater mechanism. The handle shall be capable of being padlocked in the OFF position with provisions for at least three padlocks.
- C. The Pressure Maintenance Pump Controller shall include an industrial rated motor starter with properly sized, adjustable, indirectly heated, thermal overloads on all phases. A three position HAND-OFF-AUTO selector switch rated for 600 volts shall be standard. The Pressure Maintenance Pump shall have a solid-state pressure switch, mounted internally such that the pressure switch may be removed independently. The pressure switch shall be mounted using a bulkhead fitting. The Pressure Maintenance Pump Controller shall be equipped with an adjustable solid-state minimum run timer to prevent overheating due to frequent starting. When required, an electrical step down transformer shall be furnished with a minimum capacity of 150VA and shall be fused as per UL 508. The minimum run timer shall be capable of being set for at least two minutes.
- D. The controller shall be completely tested at the factory prior to shipment. This test shall verify proper operation of all automatic and manual functions along with a continuity of all dry contacts

for remote alarms. The test shall also include a high potential voltage test of all primary power circuits equal to twice the rated voltage plus 1000 volts for one minute.

2.018PRESSURE SENSING LINES

- A. A completely separate pressure sensing line shall be provided for each fire pump and for the pressure maintenance pump. The sensing line shall be arranged in accordance with Figure A-75.2.1 of NFPA #20.
- B. All pressure sensing lines to fire pump and pressure maintenance pump controllers shall be copper. Copper pipe shall be seamless and conform to ASTM B-88. All pipe shall be Type L and shall have soldered joints. Solder shall be low lead conforming to ASTM B-32, Grade S65, (95-5).
- C. Each sensing line shall be equipped with two restrictive orifice check valves. Restricted orifice check valves shall be brass with the clapper drilled for 3/32 inch (2.4 mm). Restricted orifice check valves shall be mounted in the horizontal position, not less than 5 feet (1.5 m) apart on the sensing line.
- D. Two test connections shall be provided for each sensing line. Test connections shall consist of two brass ½ inch (15 mm) globe valves and ¼ inch (8 mm) gauge connection tee arranged per NFPA #20. One of the test connections shall be equipped with a 0 to 300 psi (0 to 1380 kPa) water oil-filled gauge.
- E. Sensing line shall be connected to the pump discharge piping between the discharge piping control valve and the check valve.

2.019PRESSURE SWITCHES

- A. Pressure switches utilized for control of fire pumps shall be UL listed for fire pump service. Each switch shall have independent high and low calibrated adjustments. The pressure sensing elements shall be capable of withstanding a momentary surge pressure of 400 psi without losing accuracy. Suitable provisions shall be made for relieving pressure to the pressure switch to allow testing of the controller operation and pumping unit.
- B. The pressure switch shall be of the bourdon tube type with adjustable independent High and Low set points with a range of 10-300 psi. The pressure switch shall be capable of being sealed to prevent unauthorized adjustment. The pressure switch shall be mounted inside the controller cabinet and piped to an external coupling for ease of field connection.

2.020FIRE PUMP TEST METER

- A. The fire pump test meter shall meet all requirements of NFPA #20 for fire pumps. The meter shall be UL listed or FM approved for this application. The meter shall be of the venturi type, iron or steel body, with flanged or grooved ends and shall be rated for pressures up to 275 psi. The flow rate shall read out on a dial graduated in GPM over the full range of the meter. The graduated dial shall be a minimum of 4.5 inches in diameter. The meter shall be accurate over the entire flow range. The meter head loss characteristics shall be compatible with the pumping systems.
- B. The meter shall be installed in strict conformance with the manufacturer's instructions and the requirements of NFPA #20. The meter dial shall be located so as to be easily readable from the operating floor without climbing on a ladder or stooping excessively.

- C. Flow meter shall be capable of metering any waterflow quantities between 50 percent and 150 percent of the rated flow of the pumps.
- D. The flow meter shall be arranged in accordance with Figure A.5.19.1.2(b) of NFPA #20.

PART 3 - EXECUTION

3.01 DESIGN CRITERIA

- A. The entire fire protection system including minor details of work and/or exact pipe routing may not be shown on the plans. The contractor is to provide the complete fire protection systems per NFPA #13R and NFPA #14 as required and provide all necessary material and labor to provide the complete system.
- B. The fire sprinkler contractor shall coordinate on site with other trades for routing of piping within the building.
- C. All piping shall be run concealed wherever possible. Where piping is run exposed, special notation on drawings to that effect shall be evident and conspicuous on the drawings. Any piping determined to be a problem by the Architect or Engineer shall be relocated at no additional cost.
- D. Pendent sprinklers in suspended acoustical tile ceilings shall be centered or quarter pointed in the ceiling tile. At no point shall the pendent sprinkler be closer than 6" from the ceiling grid.
- E. System piping shall be hydraulically calculated in accordance with NFPA #13 and NFPA #14 to the point of connection verified for flow characteristics. Hydraulic calculations shall include a 10% minimum safety cushion in the available pressure.
- F. All design areas shall be a minimum of 1,500 ft². Design areas shall not be reduced below 1,500 ft².
- G. Sprinkler system shall be zoned by floor. A separate control valve, flow switch and inspectors test and drain shall be provided for each floor. Piping to be routed horizontally through each floor.
- H. The fire protection systems design, including shop drawings and hydraulic calculations, shall be accomplished by a Professional Engineer competent in fire protection or by a NICET Level III fire sprinkler system design technician.

3.02 INSTALLATION

- A. Where details of installation are not given, the installation shall be made using manufacturer's recommended practices or at the direction of the Engineer.
- B. The contractor shall be responsible for providing all labor and material for a complete system in accordance with these specifications and applicable standards and Codes. Contractor shall provide all material and labor as necessary for any changes that may be necessary due to field conditions from the shop drawings submitted for approval. All necessary changes shall be made at no additional cost to the Owner.

- C. Contractor shall complete the fire protection systems ready for operation, in all respects, as soon as possible. When system is complete and ready for continuous operation, activate the system for its intended use. After system has been activated for continuous use, water charges will be paid by the Owner.
- D. This Contractor shall remove from the building, all rubbish and unused materials due to or connected with this installation.
- E. The surface of all piping shall be cleaned and left ready for painting. This includes the removal of any stickers or tags on the piping.

3.03 TESTING

- A. All testing shall be accomplished in accord with NFPA standards and requirements.
- B. This Contractor shall call for inspection and complete Contractor's Material and Test Certificates signed by the authority having jurisdiction.
- C. The entire sprinkler and standpipe system shall be hydrostatically tested at not less than 200 psig pressure for a period of not less than two (2) hours or 50 psi above static pressure in excess of 150 psi for two (2) hours with no pressure drop in the system.
- D. The standpipe system shall be flow tested in accordance with NFPA #14 requirements.
- E. The fire pump shall be tested in accordance with NFPA #20 requirements.
- F. The backflow prevention device shall be tested and certified as required by the local water authority and applicable codes.
- G. All testing shall be witnessed by a representative of the Engineer or Owner and the authority having jurisdiction.
- H. Where jurisdictional authority's standards are more stringent than the above test, they shall prevail.
- I. Furnish copies of all test certificates with close-out documentation.

END OF SECTION

DIVISION 22 PLUMBING
SECTION 220000 - COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, Standard General and Supplementary General Conditions, Division 1 Specification Sections, and other applicable Specification Sections including the Related Sections listed below, apply to this Section.
- B. Take cognizance of any change required in this work which may be a direct result of any alternate bid item listed and include the price deemed necessary to meet the requirements of the respective alternate.

1.2 SCOPE OF WORK:

- A. Refer to Section 011000, Summary.
- B. The Contractor shall provide labor, materials, equipment, items, articles, operations and methods listed, shown, scheduled, or mentioned on the drawings, and/or specified, including all incidentals required for their completion.
- C. The Contractor shall refer to the General part of these specifications, such as Instructions to Bidders, Special Conditions and DIVISION 1 for restrictions covering time that work can be performed in certain areas, noisy and dusty operations, sequence of work, access to restricted areas and similar types of work and operations.

1.3 WARRANTY:

- A. A minimum 1 year parts and labor warranty shall be provided for all mechanical equipment and materials. Additional warranties shall be provided as described in individual specification sections. Warranty shall begin at the completion of the project when systems are fully operating and all work has been completed. Under no circumstances shall warranty periods start until the system is operating properly.

1.4 INTERPRETATION OF DRAWINGS:

- A. The Drawings show the location and general arrangement of equipment, piping, ductwork and related items. They shall be followed as closely as elements of the construction will permit. Examine the drawings of other trades and verify the conditions governing the work on the job site. Drawings are schematic in nature, and installation may require additional offsets and modifications, including fittings, traps, valves and accessories.
- B. The architectural and structural drawings take precedence in all matters pertaining to the building structure, mechanical drawings in all matters pertaining to mechanical trades and electrical drawings in all matters pertaining to electrical trades. Report conflicts or differences to the architect/ engineer for resolution.
- C. Coordinate placement of mechanical items such as floor drains, duct openings and pipe sleeves with the general contractor.

1.5 SUBSTITUTIONS

- A. Most items in this DIVISION are eligible for substitution in accordance with the General Conditions and Supplements thereto. Where a proprietary specification is written for a particular item, then only that item may be used. All items eligible for substitution require submission of request for substitution 10 days prior to bid date. This submittal shall include specific models and capacities of equipment and not just manufacturers' literature.

- B. When the Engineer deems it necessary, to assure satisfactory installation and compatibility with other equipment, piping, ductwork, electrical provisions and other appurtenances, the Contractor shall prepare scale drawings of the substitute item showing proposed location, connections, relation to other equipment and other pertinent data such as maintenance space requirements, electrical requirements, height and weight. Drawings must receive Engineer's approval before the substitution is made.
- C. It is the Contractor's responsibility that the substitute item shall fit into the space allocated and that the item can be installed and function as intended. Should changes in the work of any Contractor become necessary as a result of any substitute item under this DIVISION, such changes shall be arranged and paid for by this Contractor.
- D. Capacities of substitute items shall not be less than that of the specified item.
- E. The performance of the factory representative and supplier on past work will be a consideration in the approval process of substitute items.
- F. The final decision as to acceptability rests with the Engineer.

1.6 WORKMANSHIP:

- A. Work shall be accomplished by workmen skilled in the particular trade, in conformance with best practices and to meet all applicable codes.
- B. The Engineer decides where work is satisfactory. This Contractor shall replace materials or equipment not properly installed or finished, without increase in payment received.

1.7 INSPECTIONS:

- A. This Contractor shall inform General Contractor of the project progress and schedule weekly. This Contractor shall notify the Engineer as the project progresses, at each of the following points:
 - 1. At the completion of under-slab piping and utilities, before piping is covered.
 - 2. At the completion of rough-in, before insulation/wall surfaces are installed.
 - 3. At the completion of fixture installation, when systems are operational. (Substantial Completion)
 - 4. At the end of construction, after substantial completion punchlist items are corrected. (Final Inspection.)

1.8 RESPONSIBILITY:

- A. The Contractor is responsible for installation of a satisfactory and complete piece of work in accordance with true intent of the drawings and specifications.
- B. Consult all drawings for the project to predetermine that the work and equipment will fit as planned.
- C. The location of piping, ducts, equipment, etc., shall be checked to ensure clearance from openings, structural members, cabinets, lights, outlets, and equipment having fixed locations. This shall be accomplished prior to fabrication of pipe or ducts.
- D. If, at any time, and in any case, changes in location of piping, ducts, equipment, etc., becomes necessary due to existing obstacles or installation of other trades shown on any of the project drawings such required changes shall be made by the Contractor at no extra cost. These changes are to be recorded on the record drawings.
- E. This Contractor is responsible to provide all incidental electrical interconnections, control wiring, etc., which are necessary for system completion and which are not specifically shown or otherwise indicated on the electrical drawings or specified in DIVISION 26.
- F. All electrical work incidental to or accomplished under this Division shall comply with all requirements of DIVISION 26.

1.9 PROJECT RECORD DOCUMENTS:

- A. For underground piping, record dimensions and invert elevations of all piping, including all offsets, fittings, cathodic protection and accessories. Locate dimensions from benchmarks that will be preserved after construction is complete.
- B. A separate set of mechanical drawings shall be maintained at the job site at all times and shall be used as record drawings. This set shall be kept up to date with all changes and/or additions in the construction and/or mechanical systems, and shall be delivered to the Engineer at the completion of this job. This set of drawings shall be kept clean and protected at all times.

1.10 DELIVERY, STORAGE AND HANDLING:

- A. Deliver, store, and handle all materials to keep clean and protected from damage.
- B. Store products in a manner acceptable to the Owner and Engineer. Provide temporary inlet and outlet caps. Maintain caps in place until installation.
- C. Protect equipment and other materials from damage after installed from construction debris and other damage.
- D. Refer to Division 1 for additional provisions to allow equipment passage into the building.

1.11 QUALITY ASSURANCE:

- A. Regulatory Requirements: Comply with the following –
 - 1. 2012 International Building Code (IBC).
 - 2. 2012 International Fuel Gas Code (IFGC).
 - 3. 2012 International Mechanical Code (IMC).
 - 4. 2014 National Electric Code (NEC).
 - 5. 2012 Uniform Plumbing Code (UPC).
 - 6. 2012 International Energy Conservation Code (IECC).
 - 7. 2012 International Fire Code.
 - 8. Current National Fire Protection Association Fire Codes (NFPA).
 - 9. All other applicable Federal, State, County, and City codes, regulations, and ordinances.
- B. All materials of a given type shall be manufactured by a single source, and supplied by a single supplier.
- C. Comply with Division 26 and all codes referenced therein for any electrical work accomplished under this Division or by this contractor.
- D. All materials and equipment shall be new, approved by the governing authority, and be in new, undamaged condition when installed.

1.12 LABELING REQUIREMENT FOR PACKAGED EQUIPMENT:

- A. Electrical panels on packaged mechanical equipment shall bear UL label or label of other approved testing agency (ETL, CSA).

1.13 PERMIT AND APPROVAL:

- A. Arrange for and obtain all permits and approvals required for the execution of the work.

1.14 MANUFACTURER'S DIRECTIONS

- A. Manufactured materials and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned as directed by the manufacturer unless noted otherwise herein or on the drawings.

- B. Certain items of equipment, as noted herein, shall be checked out, started and put into service by factory representatives.

1.15 CUTTING, PATCHING, REPAIRING

- A. Cutting, patching and repairing required by the work of this DIVISION shall be the responsibility of this Contractor.
- B. Work shall be performed in accordance with DIVISION 1 of these specifications.
- C. The performance of this work shall not weaken the structural integrity of the building.
- D. Any abrasion or disfigurement of the finished work or any portion of the building where any such abrasion or disfigurement is caused by the activities of the Contractor shall be repaired and neatly refinished to match the adjacent work.

1.16 OPENINGS IN PIPES AND DUCTS

- A. Openings in pipes and ducts shall be kept closed during progress of work.
- B. The Contractor is required to clean new systems found dirty to the satisfaction of the Engineer at no additional cost.

1.17 CLEANUP

- A. Upon completion of work, remove materials, scraps, etc., relative to this work and leave the premises in a clean and orderly condition. This applies equally to finished, unfinished and concealed spaces.
- B. Clean equipment of dirt, debris, and any overspray of finishes (paint, etc).

1.18 SAMPLES

- A. The Contractor shall submit actual production samples on any material or equipment requested if, in the Engineer's opinion, it is necessary in order to determine the quality, workmanship, operation, etc. of the item.
- B. Samples will be returned to the Contractor. Approved samples may be used on the job.
- C. Costs incurred in providing and returning samples will be the responsibility of the Contractor.

1.19 OPERATING INSTRUCTIONS

- A. Written operation and maintenance instructions, as produced by the manufacturer, shall be provided for all equipment. These instructions shall be bound and submitted as described in this Section.

1.20 REMODELING WORK

- A. Wherever existing mechanical systems, plumbing, heating, service lines, piping, ducts, controls, etc., are cut into, removed, or interrupted as a result of the contract work, all such items that serve areas or equipment that remain shall be replaced, rerouted, extended, relocated, etc., as necessary to maintain operation of equipment and services.
- B. Downtime shall be held to a minimum. Outages shall be scheduled at a time acceptable to and approved by the Owner. Consult with the Owner in sufficient time for him to make necessary preparations for the outage.
- C. Demolition:
 - 1. Refer to the drawings for execution of demolition.

2. All existing equipment and material removed and not scheduled for reinstallation shall remain the property of the Owner and shall be delivered to a designated stockpile area on the site by the Contractor. Materials not wanted by the Owner shall be removed from the site by the Contractor.

D. Asbestos Awareness

1. If suspect asbestos materials are encountered, the contractor shall cease work in that area and inform the owner of his suspicions and will not proceed with work until such time that a determination can be made on how to proceed.

E. Site Investigation

1. Before submitting his proposal, the Contractor should examine the site and building as it pertains to this Project and make allowances in his proposal for all conditions that will affect the work indicated in the Project manual and contract documents. This would include hidden and other discovered obstacles such as existing pipes, ducts and equipment not necessarily shown on the project drawings.
2. Building access may be arranged by contacting the Owner.

PART 2 - SUBMITTALS AND BROCHURES OF EQUIPMENT (OPERATION & MAINTENANCE MANUALS)

2.1 GENERAL

- A. The literature required to be submitted and approved in order to fulfill the requirements of this DIVISION falls into two general categories. These are the "Brochures of Equipment" and "Submittals."

1. The "Brochures of Equipment", as the name implies, shall contain all pertinent information for all equipment installed. These books are required to be turned over to the Owner and approved before final payment is authorized. Special training for certain equipment may require the use of this book at an earlier stage of project completion. In these instances, the Contractor will be required to prepare and submit the applicable portions of the Brochures of Equipment significantly before project completion.

2. "Submittals" is a general term for informational literature which must be supplied to and approved by the Contractor prior to installing, receiving, or in some instances, even ordering equipment. The normal required types of submittals include shop drawings, manufacturer's literature, installation and operation instructions (from the manufacturer) and wiring diagrams. System reports, such as start-up reports or balancing reports, and the Project Completion Checklist are two forms of submittals which are required after the equipment has been installed and is operational. Each Section of this Division may contain special or more specific requirements for expanded or additional types of submittal literature. These shall be provided as required by each Section.

3. In general, copies of all returned, approved submittals shall be included in the Brochures of Equipment. These books shall also include complete operation and maintenance literature for each piece of equipment such as may be packaged with the equipment for OEM components. They will be used by the Owner's personnel as the primary source of information for operating and maintaining the installed systems and as such, they shall exhibit a high degree of clarity, thoroughness and be suitably bound and arranged to be useful and durable throughout the life of the installed systems.

2.2 SUBMITTALS

- A. The contractor shall procure manufacturer's literature and/or certified prints for all items of equipment, materials or systems on the job. Shop drawings and literature shall be complete and marked showing name of job, item used, size, dimensions, capacity, rough-in, etc., as required for complete check and installation. Any exceptions of the equipment being furnished from that specified shall be clearly identified. Specific requirements of submittals may be expanded in individual specification sections. Minimum requirements shall include the following:
1. Submit actual installation layout drawings on floor plans showing pipe and duct runs. Provide such drawings for systems such as underground pipe and boiler flue systems.
 2. Manufacturer's literature shall include any and all restrictions on the application and installed service limitations of the product.
 3. All shop drawings shall be reviewed, approved and stamped by the Contractor before submittal to the Architect/Engineer.
 4. All items of equipment and systems which are to be installed as specified or are not otherwise designated as requiring Owner's or Engineer's approval, will require a letter of compliance by the Contractor stating that these items or system will be provided as specified and will be reviewed and stamped by the contractor.
 5. Submittals for any piece of equipment or system which is a substitute from that specified or of any equipment or system specifically directing Engineer's review shall be forwarded to the owner or Engineer (as designated) for review. This submittal shall be made within 30 days of award of contract or specified item shall be furnished. The Contractor shall check submittals for number of copies, adequate identification, correctness and compliance with drawings and specifications and apply his stamp of approval before forwarding the submittal. Submittals shall be revised, changed and/or resubmitted until acceptable and approved by the Owner's representative.
 6. Approval of submittals and literature by the owner or Engineer shall not relieve the Contractor from responsibility for deviations from drawings or specifications, nor shall it relieve him from responsibility for errors in shop drawings or other submittal literature.
 7. Submit submittals in PDF form for review. Combine all equipment submittal sheets into one file (as file size permits).
 8. Copies or scanned documents which are not of a permanent or legible nature will not be accepted for shop drawing submittals. Copies must be legible with all dimensions and other pertinent data clear.

2.3 BROCHURES OF EQUIPMENT

- A. The Contractor shall prepare and submit two complete Brochures of Equipment. Each shall contain all required submittal data for the construction materials and each piece of equipment (reference Submittal Schedule, 220500 2.2) installed under this project. The literature required for submittal purposes shall be expanded to include operation and maintenance literature for each piece of equipment. Maintenance information shall be complete in every respect and shall include parts lists and assembly drawings wherever applicable. Manuals, catalogs, etc., shall be new, as supplied by the factory, and not photocopied.

- B. All literature shall clearly indicate the equipment it represents and shall be labeled with the equipment identification abbreviation found on the drawings, e.g. EF-1, etc. All information which is not applicable to the particular model and size supplied shall be clearly and neatly crossed out with heavy black marker or other suitable means. This includes dimensional drawings, maintenance information, parts lists, wiring diagrams, etc. Only the information applicable to the particular equipment supplied shall remain and it shall be easy to follow. Booklets not meeting these requirements shall be returned for correction.
- C. Binders shall be high quality telescoping post type with slide or lever release, metal hinges, and covered hardboard or rigid plastic covers.
- D. Dividers shall be used to separate the literature for equipment supplied under each of the various Sections of this DIVISION. Divider headings shall read the same as the Section title e.g. "233400 FANS."
- E. Large size drawings or diagrams shall be folded and placed in heavyweight sheets with pockets.
- F. The format of the Brochure shall begin with the submittal requirement list at the front as an index sheet. The dividers for each section shall then progress sequentially and the project completion checklist shall be included at the back as the appendix.
- G. Authorization for final payment shall not be made prior to final acceptance of the Brochures of Equipment.

PART 3 - PRODUCTS

3.1 FIRE STOPPING:

- A. Provide UL classified firestopping system for mechanical penetrations through fire rated construction to maintain the fire rating. See Section 220100 - Penetration Firestopping for Plumbing for additional details.
 - 1.Manufacturers: TREMCO, Johns Manville, 3M, Rectorseal, Hilti.
- B. Metallic pipe, duct and other penetrations of all fire partitions, walls and floors shall be effectively fire-stopped to equal the fire rating of the floor or partition using materials and methods UL approved and tested to meet all conditions of ASTM E119, UL 1479 and ASTM 814 tests. One such material is Carborundum bulk "Fiberfrax" fiber packing for filling the annular space between pipe and sleeve or hole and Fiberfrax LDS moldable caulking for sealing in the fiber packing. Other acceptable materials are Dow Corning 3-6548 Silicon RTV foam firestop system, General Electric 'Pensil' 851 system or U.S.G. fire code compound and Thermafire.
- C. PVC pipe, duct penetrations to be fire stopped same as metallic penetrations with the addition of an intumescent wrap to effectively close the hole if PVC vaporizes.
- D. Construction of permanent bracing, framing, roof curbs and platforms or other structures which utilize wood construction shall be fabricated from fire resistant treated materials or shall be otherwise protected by approved fire resistant materials.
- E. Penetrations of fire rated floors, walls, and ceilings shall be fire stopped to equal the fire rating of the component using materials and methods meeting UL approvals and standards. Refer to the attached figures for specific penetration requirements. Figures represent typical installations required in the building. For specific situations not covered by the figures refer to the fire-stop manufacturer's installation details.

3.2 ACCESS PANELS:

- A. Furnish access panels to access valves, traps, control valves or devices, dampers, damper motors, etc. Access panels shall be sized as necessary for ample access, or as indicated on drawings, but no smaller than 12" x 12" where devices are within easy reach of operator, and at least 24"x24" when operator must pass through opening in order to reach the devices. Provide Milcor Style "DW" or "M" doors.

- B. Access panels in fire rated walls or ceiling must be U.L. labeled for intended use, similar and equal to Ruskin #APW1. Unless otherwise indicated on plans, access doors shall be hinged flush type steel framed panel, 14 gauge minimum for frame, and with anchor straps. Only narrow border shall be exposed. Hinges shall be concealed type. Locking device shall be flush type and screw driver operated. Metal surfaces shall be prime coated with rust-inhibitive paint. Panels shall be compatible with architectural adjacent materials Manufacturer: Milcor, Bilco

3.3 BUILDING ATTACHMENTS FOR MECHANICAL WORK SUPPORTS:

A. General Requirements:

1. Provide building attachments required for supporting mechanical work, suitably selected and installed for the loads applied with a minimum additional safety factor of 3.
2. Where specified attachments are not suitable for conditions, submit to Engineer for approval, proposal for alternate building attachments.
3. Approved Manufacturers: Anvil, or equivalent products by Michigan Hanger and B-Line.
4. Provide supplemental trapeze supports where necessary. Design trapeze to support all trades. Coordinate loads, and supports with all trades. Size trapeze for maximum deflection of 1/64 of the span.

B. Attachments to Structural Steel:

1. Support mechanical work from building structural steel where possible and approved. No welding or bolting to structural steel is permitted unless authorized by Architect. C-clamps are not permitted.
 - a. Center beam clamp - for loads over 120 lb.: Malleable center hung Anvil Fig. 228.
 - b. Side beam clamp with retaining clips - for loads up to 120 lb.

C. Cast in Place Concrete Inserts:

1. Provide inserts selected for applied load of present load plus 100% for future, and coordinated with concrete work. Except as detailed on drawings, inserts shall be Unistrut or Grinnell. Plan, lay out and coordinate setting of inserts prior to concrete pour. Use Anvil Fig. 285 lightweight concrete insert for loads up to 400# or Anvil Fig. 281 Wedge Type concrete insert for loads up to 1200#

D. Drilled Insert Anchors:

1. Where mechanical work cannot be supported from structural steel, or cast in place concrete inserts, provide drilled concrete insert anchors. Submit for approval, project specific installation drawings for all loads over 100 lbs. Install inserts in web of beam if possible and approved. Insert depth shall not exceed two thirds the thickness of the concrete. Where existing concrete appears to be deteriorating, or where applied load at insert exceeds 1000 lbs., conduct test of concrete to determine derated capacity of insert. Anchors may be adhesive or expansion type up to 1000 lbs., and shall be adhesive type for loads over 1000 lbs.
Manufacturers: Hilti, Powers Fasteners.

PART 4 - EXECUTION

4.1 GENERAL REQUIREMENTS

- A. Install equipment and materials in accordance with manufacturer's written and illustrated instructions, as detailed on drawings and as described in these specifications. Bring discrepancies in installation methods to the attention of the owner and A/E.
- B. Install hanger rod straight, without bending.

4.2 REFRIGERANT HANDLING

- A. Refrigerant Installation and Disposal: Perform all work related to refrigerant contained in chillers, cooling coils, air conditioners, and similar equipment, including related piping, in strict accordance with the following requirements:
 - 1. ASHRAE Standard 15 and Related Revisions: Safety Code for Mechanical Refrigeration.
 - 2. ASHRAE Standard 34 and Related Revisions: Number Designation and Safety Classification of Refrigerants.
 - 3. United States Environmental Protection Agency (US EPA) requirements of Section 808 (Prohibition of Venting and Regulation of CFC) and applicable State and local regulations of authorities having jurisdiction.
- B. Recovered refrigerant is the property of the Contractor. Dispose of refrigerant legally, in accordance with applicable rules and regulations of authorities

4.3 COMPLETION AND TESTS

- A. The contractor shall inform the engineer of progress throughout construction as necessary to complete inspections. Inspections shall include rough-in, substantial completion and final completion.
 - 1. The rough-in inspection shall be completed prior to sheetrock or ceiling installation.
 - 2. The substantial completion inspection shall be performed after all work has been completed and systems are operating correctly. During the substantial completion inspection, a functional system test shall be performed by the installer(s) in the presence of the Engineer and owner's designated representatives. During the test the contractor shall demonstrate that all systems and equipment perform in the manner described in the specifications and indicated on the drawings. Any systems found not to be operating properly shall be repaired and followed up with an additional functional system test. After substantial completion a list of mechanical construction deficiencies (punchlist) shall be prepared and sent to the mechanical contractor.
 - a. Representatives familiar with each piece of equipment shall be present for the system testing to discuss operational and maintenance issues.
 - 3. The Engineer's final inspection shall be completed after the mechanical contractor has completed or repaired all items listed in the construction deficiencies list. The contractor shall not request final inspection until the deficiencies list has been fully completed.

END OF SECTION 220000

SECTION 220100 – PENETRATION FIRESTOPPING FOR PLUMBING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Section, apply to work specified in this section.

1.2 DEFINITION:

- A. Firestopping: Material or combination of materials used to retain integrity of fire-rated construction by maintaining an effective barrier against the spread of flame, smoke, and hot gases through penetrations in fire rated wall and floor assemblies.

1.3 GENERAL DESCRIPTION OF THE WORK OF THIS SECTION

- A. Only tested firestop systems shall be used in specific locations as follows:
 - 1. Penetrations for the passage of duct, piping, and other mechanical equipment through fire-rated vertical barriers (walls and partitions), horizontal barriers (floor/ceiling assemblies), and vertical service shaft walls and partitions.
 - 2. Repetitive plumbing penetrations in fire-rated floor assemblies. Penetrations exist for the installation of tubs, showers, aerators and other plumbing fixtures.

1.4 RELATED WORK OF OTHER SECTIONS

- A. Coordinate work of this section with work of other sections as required to properly execute the work and as necessary to maintain satisfactory progress of the work of other sections, including:
 - 1. Section 03 30 00 - Cast-In-Place Concrete
 - 2. Section 04 20 00 - Masonry Work
 - 3. Section 07 84 00 - Firestopping
 - 4. Section 07 90 00 - Joint Sealants
 - 5. Section 09 20 00 - Plaster and Gypsum Board
 - 6. Section 13 48 00 - Sound, Vibration and Seismic Control
 - 7. Division 21 - Fire Suppression
 - 8. Division 22 - Plumbing
 - 9. Division 23 - Heating, Ventilating, and Air Conditioning (HVAC)

1.5 REFERENCES

- A. Test Requirements: ASTM E 814, "Standard Method of Fire Tests of Through Penetration Fire Stops"
- B. Test Requirements: UL 1479, "Fire Tests of Through-Penetration Firestops"
- C. Underwriters Laboratories (UL) of Northbrook, IL publishes tested systems in their "FIRE RESISTANCE DIRECTORY" that is updated annually.
 - 1. UL Fire Resistance Directory:
 - a. Firestop Devices (XHJI)
 - b. Fire Resistance Ratings (BXRH)
 - c. Through-Penetration Firestop Systems (XHEZ)
 - d. Fill, Voids, or Cavity Material (XHHW)
 - e. Forming Materials (XHKU)
- D. International Firestop Council Guidelines for Evaluating Firestop Systems Engineering Judgments
- E. Inspection Requirements: ASTM E 2174, "Standard Practice for On-site Inspection of Installed Fire Stops."

- F. ASTM E 84, "Standard Test Method for Surface Burning Characteristics of Building Materials."
- G. International Building Code (IBC 2009).
- H. NFPA 101 - Life Safety Code

1.6 QUALITY ASSURANCE

- A. A manufacturer's direct representative (not distributor or agent) to be on-site during initial installation of firestop systems to train appropriate contractor personnel in proper selection and installation procedures. This will be done per manufacturer's written recommendations published in their literature and drawing details.
- B. Firestop System installation must meet requirements of ASTM E 814 or UL 1479 tested assemblies that provide a fire rating equal to that of construction being penetrated.
- C. Proposed firestop materials and methods shall conform to applicable governing codes having local jurisdiction.
- D. Firestop Systems do not reestablish the structural integrity of load bearing partitions/assemblies, or support live loads and traffic. Installer shall consult the structural engineer prior to penetrating any load bearing assembly.
- E. For those firestop applications that exist for which no UL tested system is available through a manufacturer, a manufacturer's engineering judgment derived from similar UL system designs or other tests will be submitted to local authorities having jurisdiction for their review and approval prior to installation. Engineering judgment drawings must follow requirements set forth by the International Firestop Council.

1.7 SUBMITTALS

- A. Submit Product Data: Manufacturer's specifications and technical data for each material including the composition and limitations, documentation of UL firestop systems to be used and manufacturer's installation instructions to comply with Section 01 30 00.
- B. Manufacturer's engineering judgment identification number and drawing details when no UL system is available for an application. Engineering judgment must include both project name and contractor's name who will install firestop system as described in drawing.
- C. Submit material safety data sheets provided with product delivered to job-site.

1.8 INSTALLER QUALIFICATIONS

- A. Engage an experienced Installer who is certified, licensed, or otherwise qualified by the firestopping manufacturer as having been provided the necessary training to install manufacturer's products per specified requirements. A manufacturer's willingness to sell its firestopping products to the Contractor or to an Installer engaged by the Contractor does not in itself confer qualification on the buyer.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials undamaged in manufacturer's clearly labeled, unopened containers, identified with brand, type, and UL label where applicable.
- B. Coordinate delivery of materials with scheduled installation date to allow minimum storage time at job-site.
- C. Store materials under cover and protect from weather and damage in compliance with manufacturer's requirements.
- D. Comply with recommended procedures, precautions or remedies described in material safety data sheets as applicable.
- E. Do not use damaged or expired materials.

1.10 PROJECT CONDITIONS

- A. Do not use materials that contain flammable solvents.
- B. Scheduling
 - 1. Schedule installation of CAST IN PLACE firestop devices after completion of floor formwork, metal form deck, or composite deck but before placement of concrete.
 - 2. Schedule installation of other firestopping materials after completion of penetrating item installation but prior to covering or concealing of openings.
- C. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.
- D. Weather conditions: Do not proceed with installation of firestop materials when temperatures exceed the manufacturer's recommended limitations for installation printed on product label and product data sheet.
- E. During installation, provide masking and drop cloths to prevent firestopping materials from contaminating any adjacent surfaces.

PART 2 PRODUCTS

2.1 FIRESTOPPING – GENERAL

- A. Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by the firestopping manufacturer based on testing and field experience.
- B. Provide components for each firestopping system that are needed to install fill material. Use only components specified by the firestopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.
- C. Penetrations in Fire Resistance Rated Walls: Provide firestopping with ratings determined in accordance with UL 1479 or ASTM E 814.
 - 1. F-Rating: Not less than the fire-resistance rating of the wall construction being penetrated.
- D. Penetrations in Horizontal Assemblies: Provide firestopping with ratings determined in accordance with UL 1479 or ASTM E 814.
 - 1. F-Rating: Minimum of 1-hour rating, but not less than the fire-resistance rating of the floor construction being penetrated.
 - 2. T-Rating: when penetrant is located outside of a wall cavity, minimum of 1-hour rating, but not less than the fire-resistance rating of the floor construction being penetrated.
- E. Penetrations in Smoke Barriers: Provide firestopping with ratings determined in accordance with UL 1479 or ASTM E 814.
 - 1. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at both ambient and elevated temperatures.
- F. Mold Resistance: Provide penetration firestopping with mold and mildew resistance rating of 0 as determined by ASTM G21.

2.2 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with through penetration firestop systems (XHEZ) listed in Volume II of the UL Fire Resistance Directory, provide products of the following manufacturers as identified below:
 - 1. Hilti, Inc., Tulsa, Oklahoma
800-879-8000
www.us.hilti.com
 - 2. Others as approved.

2.3 MATERIALS

- A. Use only firestop products that have been UL 1479 or ASTM E 814 tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire-rating involved for each separate instance.
- B. Pre-installed firestop devices for use with noncombustible and combustible pipes (closed and open systems) penetrating concrete floors and/or gypsum walls, the following products are acceptable:
 - 1. Hilti Cast-In Place Firestop Device (CP 680-P)
 - a. Add Aerator Adaptor when used in conjunction with aerator system.
 - 2. Hilti Tub Box Kit (CP 681) for use with tub installations.
 - 3. Hilti Cast-In Place Firestop Device (CP 680-M) for use with noncombustible penetrants.
 - 4. Hilti Speed Sleeve (CP 653) for use with cable penetrations.
 - 5. Hilti Firestop Drop-In Device (CFS-DID) for use with noncombustible and combustible penetrants.
 - 6. Hilti Firestop Block (CFS-BL)
- C. Sealants, caulking materials, or foams for use with non-combustible items including steel pipe, copper pipe, rigid steel conduit and electrical metallic tubing (EMT), the following products are acceptable:
 - 1. Hilti Intumescent Firestop Sealant (FS-ONE)
 - 2. Hilti Self-leveling Firestop Sealant (CP 604)
 - 3. Hilti Fire Foam (CP 620)
 - 4. Hilti Flexible Firestop Sealant (CP 606)
 - 5. Hilti Elastomeric Firestop Sealant (CP 601S)
- D. Sealants or caulking materials for use with sheet metal ducts, the following products are acceptable:
 - 1. Hilti Elastomeric Firestop Sealant (CP 601S)
 - 2. Hilti Flexible Firestop Sealant (CP 606)
 - 3. Hilti Intumescent Firestop Sealant (FS-ONE)
- E. Intumescent sealants, caulking materials for use with combustible items (penetrants consumed by high heat and flame) including insulated metal pipe, PVC jacketed, flexible cable or cable bundles and plastic pipe, the following products are acceptable:
 - 1. Hilti Intumescent Firestop Sealant (FS-ONE)
- F. Foams, intumescent sealants, or caulking materials for use with flexible cable or cable bundles, the following products are acceptable:
 - 1. Hilti Intumescent Firestop Sealant (FS-ONE)
 - 2. Hilti Fire Foam (CP 620)
 - 3. Hilti Elastomeric Firestop Sealant (CP 601S)
 - 4. Hilti Flexible Firestop Sealant (CP 606)
- G. Non-curing, re-penetrable, intumescent putty or foam materials for use with flexible cable or cable bundles, the following products are acceptable:
 - 1. Hilti Firestop Putty Stick (CP 618)
 - 2. Hilti Firestop Plug (CFS-PL)
- H. Firestop collar or wrap devices attached to assembly around combustible plastic pipe (closed and open piping systems), the following products are acceptable:
 - 1. Hilti Firestop Collar (CP 643N)
 - 2. Hilti Firestop Collar (CP 644)
 - 3. Hilti Wrap Strips (CP 648E/648S)
- I. Materials used for large openings and complex penetrations made to accommodate cable trays and bundles, multiple steel and copper pipes, electrical busways in raceways, the following products are acceptable:

1. Hilti Firestop Mortar (CP 637)
 2. Hilti Firestop Block (CFS-BL)
 3. Hilti Fire Foam (CP 620)
 4. Hilti Firestop Board (CP 675T)
- J. Non curing, re-penetrable materials used for large openings and complex penetrations made to accommodate cable trays and bundles, multiple steel and copper pipes, electrical busways in raceways, the following products are acceptable:
1. Hilti Firestop Block (CFS-BL)
 2. Hilti Firestop Board (CP 675T)
- K. For blank openings made in fire-rated wall or floor assemblies, where future penetration of pipes, conduits, or cables is expected, the following products are acceptable:
1. Hilti Firestop Block (CFS-BL)
 2. Hilti Firestop Plug (CFS-PL)
- L. Provide a firestop system with a "F" Rating as determined by UL 1479 or ASTM E 814 which is equal to the time rating of construction being penetrated.

PART 3 EXECUTION

3.1 PREPARATION

- A. Verification of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.
1. Verify penetrations are properly sized and in suitable condition for application of materials.
 2. Surfaces to which firestop materials will be applied shall be free of dirt, grease, oil, rust, laitance, release agents, water repellents, and any other substances that may affect proper adhesion.
 3. Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.
 4. Comply with manufacturer's recommendations for temperature and humidity conditions before, during and after installation of firestopping.
 5. Do not proceed until unsatisfactory conditions have been corrected.

3.2 COORDINATION

- A. Coordinate location and proper selection of cast-in-place Firestop Devices with trade responsible for the work. Ensure device is installed before placement of concrete.
- B. Responsible trade to provide adequate spacing of field run pipes to allow for installation of cast-in-place firestop devices without interferences.

3.3 INSTALLATION

- A. Regulatory Requirements: Install firestop materials in accordance with UL Fire Resistance Directory.
- B. Manufacturer's Instructions: Comply with manufacturer's instructions for installation of through-penetration joint materials.
1. Seal all holes or voids made by penetrations to ensure an air and water resistant seal.
 2. Consult with mechanical engineer, project manager, and damper manufacturer prior to installation of UL firestop systems that might hamper the performance of fire dampers as it pertains to duct work.
 3. Protect materials from damage on surfaces subjected to traffic.

3.4 FIELD QUALITY CONTROL

- A. Examine sealed penetration areas to ensure proper installation before concealing or enclosing areas.
- B. Keep areas of work accessible until inspection by applicable code authorities.

- C. Inspection of through-penetration firestopping shall be performed in accordance with ASTM E 2174, "Standard Practice for On-Site Inspection of Installed Fire Stops" or other recognized standard.
- D. Perform under this section patching and repairing of firestopping caused by cutting or penetrating of existing firestop systems already installed by other trades.

3.5 ADJUSTING AND CLEANING

- A. Remove equipment, materials and debris, leaving area in undamaged, clean condition.
- B. Clean all surfaces adjacent to sealed holes and joints to be free of excess firestop materials and soiling as work progresses.

END OF SECTION 220100

SECTION 220519 – THERMOMETERS, PRESSURE GAUGES, AND ACCESSORIES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, Standard General and Supplementary General Conditions, Division 1 Specification Sections, and other applicable Specification Sections including the Related Sections listed below, apply to this Section.

1.2 SCOPE OF WORK:

- A. Provide thermometers, pressure gauges, and accessories as specified, where specified and where shown on drawings. See drawings for additional details.

1.3 QUALITY ASSURANCE

- A. UL Compliance: Comply with applicable UL standards pertaining to meters and gauges.
- B. ASME and ISA Compliance: Comply with applicable portions of ASME and Instrument Society of America (ISA) standards pertaining to construction and installation of meters and gauges.
- C. ASME/ANSI B40.1, Pressure Gauge Standard.

PART 2 PRODUCTS

2.1 THERMOMETERS:

- A. Digital Thermometer: electronic, with LCD display and solar cell, clear plastic window, adjustable angle, separable socket.

1. Range and accuracy: -40 to 300 deg.F, accuracy greater of (+/-) 1 deg.F or 1% of reading.
2. Manufacturers: Weiss Model DVBM25 (vari-angle), Tech Controls

- B. Industrial Glass Thermometer: Adjustable angle, scale to be 9" long with white aluminum back and black graduation, aluminum or polyester casing, red appearing liquid tube, glass window. Stem for air duct shall be 12" long with protective aluminum slotted bulb guard and mounting flange. Stem for piping shall be 3-1/2" long aluminum, brass or stainless steel stem to match specified thermometer well. Adjust stem length for insulation extension.

1. Range and accuracy: (+/-) 1 scale div. Except where otherwise noted, select range for maximum precision for system served:
2. Manufacturers: Ashcroft, H. O. Trerice, Marsh, Weksler, Weiss.

Service	Range (deg. F)	
Domestic Cold Water	30-130 or 0-120	
Domestic Hot Water	30-180	
All other locations	shown on drawings	

- C. Thermometer Wells: Brass or stainless steel, with neck extension for insulated piping, with cap and chain fastened to well. 3/4"NPT, 2 1/2" insertion length, and 3 1/2" extension length.

- D. Outdoor thermometers shall be ultraviolet proof and specifically manufactured for outdoor use.

2.2 PRESSURE GAUGES

- A. Unless otherwise noted, provide all pressure gauges with clear window, cast aluminum or cast polypropylene case, black on white face, stainless steel tube and movement, brass 1/2" MPT socket, 1% full scale accuracy complying with ASME/ANSI B40-1 Grade 1A.

- B. Water Services through 2" piping (Utility/Economy): 2 1/2" diameter face, stainless steel case, brass 1/4" MPT socket, 2% full scale accuracy.
- C. Water Services over 2" piping: 4 1/2" diameter face, 6" diameter face for location more than 8 feet above floor, sealed glass window, glycerin filled for connections within 10 feet of pumps.
- D. Differential Pressure Gauges: 4 1/2" diameter face, 6" diameter face for location more than 8 feet above floor, sealed glass window, glycerin filled for connections within 10 feet of pumps Applicable for the following locations:
- E. Except where noted otherwise, select range for twice normal operating pressure:

Service	Range	
Water (CW and HW)	0-100 psig	

- F. Outdoor gauges shall be ultraviolet proof and specifically manufactured for outdoor use.
- G. Manufacturers: Ashcroft, H. O. Trerice, Marsh, Weksler, Weiss.

2.3 PRESSURE/TEMPERATURE TEST PLUGS AND KITS:

- A. Provide 1/4" brass pressure and temperature test plugs where shown on drawings, with two core Nordel rated for 275 degrees and 300 psig.
- B. Provide one readout meter kit including double hoses with a 4-1/2" dial differential pressure gauge. Gauge shall read 0 to 60 psig and have end connections to match both the flow valves and plugs. Included in the case shall be two pocket thermometers (25 to 125 and 0 to 220 degrees), one gauge adapter, and one pocket pressure gauge (0 to 160 psig). Meter shall become property of U of M (hand over to project engineer) after completion of work.
- C. Manufacturers:
 1. Plugs: Petes, Sisco, Schrader
 2. Meter: Auto Flow, Griswold

PART 3 EXECUTION

3.1 THERMOMETERS INSTALLATION

- A. Install and orient wells and thermometers so thermometer can be read from the floor. Digital thermometers shall be located in areas with adequate light, where possible.
- B. Thermometer Wells: For piping 2" and below, install in piping tee where thermometers are indicated, in vertical position.. For piping below 2 1/2" and above, "weldolets" may be used. Fill well with oil or graphite and secure cap
- C. Install in the following locations and elsewhere as indicated:
 1. At inlet and outlet of each thermal storage tank or water heater.
 2. At outside air intake ductwork.
 3. At mixed air plenums.
 4. At hot/cold deck plenums.
 5. At supply duct of single zone systems.

3.2 INSTALLATION OF PRESSURE GAUGES

- A. Install pressure gauges with 1/2" isolation ball valve. Locate gauges to be readable from the floor preferably at eye level. Mount gauges securely to prevent excessive vibration. Do not install pressure gauges on bottom of piping.
- B. Install in the following locations, and elsewhere as indicated on drawings:
 1. At suction and discharge of each pump.
 2. At inlet and outlet of each pressure-reducing valve.

3. At building water service entrance.

3.3 INSTALLATION OF TEST PLUGS

- A. Test Plugs: Install in piping tee where indicated, located on pipe at most readable position. Secure cap.

3.4 ADJUSTING AND CLEANING

- A. Adjusting: Adjust faces of meters and gauges to proper angle for best visibility.
- B. Cleaning: Clean meters and gauges. Replace cracked and broken windows. Touch up scratches.

END OF SECTION 220519

SECTION 220523 – VALVES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, Standard General and Supplementary General Conditions, Division 1 Specification Sections, and other applicable Specification Sections including the Related Sections listed below, apply to this Section.

1.2 SCOPE OF WORK:

- A. Provide valves as scheduled and specified for the following systems:
 - 1. Cold Water, Hot Water, Hot Water Return
 - 2. Natural Gas

1.3 QUALITY ASSURANCE:

- A. Manufacturers Standardization Society of the Valve and Fittings Industry (MSS) Compliance: Comply with the applicable MSS Standard Practices referenced.
- B. Valves of the same type or function shall be of the same manufacturer throughout the job.
- C. Provide specialty operators (e.g. chain operators, etc.), indicators, locks and stops, etc., as noted herein, shown on plans or required for proper function of the valve.

1.4 RELATED SECTIONS:

- A. Specialty valves are specified in system sections. Where applicable, section number is listed in ()
- B. For fire protection systems and specialties, see Division 21.

PART 2 PRODUCTS

2.1 VALVE APPLICATION SCHEDULE:

- A. Cold Water, Hot Water and Hot Water Return System:

Isolation through 2": Ball Valve, NSF labeled
Isolation 2 1/2" and larger: High Performance Butterfly Valve, All stainless steel.
Check: Swing Check through 2", Silent Check for 2 1/2" and up.
Balancing: Automatic Balancing Valve, Manual Balancing Valve
Specialty Valves:

- B. Natural Gas System:

Isolation through 1-1/2": Ball Valve certified by UL or CSA for natural gas.
Isolation 2 1/2" and larger: Lubricated Plug Valve (Section 231123)

2.2 GENERAL VALVE REQUIREMENTS:

- A. All valves shall have seats, stem seals and disc materials compatible with intended fluid, temperature, pressure and service.
- B. All EPDM shall be peroxide cured. All wetted seals shall be made from materials that are immune from chloramine degradation.
- C. Gate and globe valves shall be repackable under pressure whether open or closed.
- D. Unless noted otherwise, valves shall be rated for a minimum of 125# WSP (working steam pressure)/ 250# WOG (cold water, oil, gas).

- E. Unless noted otherwise, all butterfly valves shall be full lug construction, suitable for bi-directional dead end service, and have open position memory stop. Manually operated butterfly valves 4" and larger shall have enclosed worm gear operators with position indicators.
- F. Provide extended valve stems for insulated piping.
- G. Where the valves are installed outdoors, all components including the gear operated wheel operators shall be weatherproofed.
- H. Unless noted otherwise, valves through 2" shall have screwed connections for steel piping and sweat connections for copper piping; valves 2-1/2" and larger shall be flanged. Grooved connections are permitted where specified.
- I. Unless noted otherwise, valves shall be same size as piping.
- J. Isolation valves shall be ball valves.
- K. Ball valves shall not be used in lieu of balancing cocks.
- L. Availability of sizes and connection types for listed models may be limited in some cases. In such an instance, flanged connections may be used for valves less than 3" in size but screwed or soldered connections on sizes larger than 3" will not be allowed without engineer's approval.
- M. When model numbers are identical for valves with seats or discs of different composition, the materials appropriate for the intended service shall be supplied.

2.3 BALL VALVE:

- A. Two-piece, full port, bronze body, stainless steel ball and stem, Teflon seat, plastic coated lever handle and locking devices where noted in drawings.
 - 1. Valves for Natural Gas shall be UL or CSA approved for natural gas service.
 - 2. Valves for domestic hot and cold water shall be NSF labeled.
- B. Manufacturers: Jomar T-100-SS and S-100-SS, Jamesbury series 300, Grinnell 3700-6 and 3700SJ-6, Watts series B-6000, Nibco, Apollo, Pegler, Crane, Milwaukee, American Valve, Hammond

2.4 HIGH PERFORMANCE BUTTERFLY VALVE:

- A. Full lug, high performance type, carbon steel body, 316 stainless steel disc, stainless steel shaft and bearing, PTFE seat, Teflon stem packing. Rated for 150 psi, 450 degrees F.
- B. Manufacturers: Bray – Braylok Series 41, Dezurik - BHP, Grinnell - GHP, Jamesbury - 815L, Keystone - model K-LOK 362, Milwaukee - HP Series, Tri-Seal Valve-Contromatics (formerly Watts/KF Contromatics), Xomox Pliaseal.
- C. For domestic water systems, full lug, high performance type, 316 stainless steel body, 316 stainless steel disc, stainless steel shaft and bearing, (all wetted parts stainless steel) PTFE seat, Teflon stem packing. Rated for 150 psi, 250 degrees F.

2.5 BUTTERFLY VALVE - GROOVED:

- A. Grooved ductile iron body, suitable for installation with grooved piping, EPDM coated steel disc and shaft, stainless steel hub bearing, EPDM seat, Teflon stem packing. Rated for 300 psi, 230 degrees F.
 - 1. Manufacturer: Victaulic Vic-300
- B. Grooved Nylon coated ductile iron body, EPDM coated ductile iron disc, stainless steel shaft, bronze shaft bearing. MSS SP-67
 - 1. Manufacturer: Grinnell Gruvlock Series 7700.
- C. Grooved butterfly valves may be used only where grooved piping is specified.

2.6 GATE VALVE - BRONZE (FOR 2" AND SMALLER ONLY):

- A. Bronze body and trim, screwed, rising stem, double wedge or disc. Deep stuffing box with gland and back seating capacity.
 - 1. Provide union bonnet where indicated on drawings.
 - 2. Utility Tunnels: 300# Class valves required.
- B. Manufacturers: Stockham No: B105, Crane No: 428, Grinnell No: 3090, Nibco.

2.7 SWING CHECK VALVE:

- A. Bronze body and trim.
- B. Manufacturers: Milwaukee model 509, Crane model 37, Grinnell model 3300, Nibco

2.8 SILENT CHECK VALVE:

- A. Spring loaded type check valves, stainless steel spring, iron body, and bronze trim.
- B. Manufacturers: -
 - 1. Wafer Style: Milwaukee - Series 1400, APCO - Series 300, Mueller, Metraflex
 - 2. Globe Style: Milwaukee, APCO, Mueller, Metraflex

2.9 DRAIN VALVE:

- A. General Service: Ball valve with 3/4-inch hose thread and cap.

2.10 AUTOMATIC BALANCING VALVE:

- A. Automatic flow control, pressure independent type, +/- 5 percent accuracy. 304 stainless steel cartridge, two P/T ports for flow reading. Valve size shall match pipe size. Refer to drawings for flow and pressure range.
- B. Manufacturers: Griswold Ultra "Z", Autoflow, Bell and Gossett

2.11 MANUAL BALANCING VALVES:

- A. General Manual Balancing Valve Requirements: ports for measuring flow, memory stop, bubble tight shut-off, valve Cv characteristics suitable for throttling. Size valve to produce readable design flow and maximum full open pressure drop of 3 feet.
- B. Through 2": bronze body, brass ball, calibrated.
Manufacturers: Bell & Gossett Circuit Setter Plus, Armstrong, Flow Design Inc., TACO, T&A
- C. Valves 2-1/2" and larger: cast iron body, brass ball or bronze disc, TFE seat rings, bronze seat, and stainless steel stem.
Manufacturers: Bell & Gossett Circuit Setter, Armstrong, Flow Design Inc., TACO, T&A
- D. Venturi Style: bronze body, brass ball, and venturi flow measuring station. Manufacturers: Preso B Plus, Accusetter
- E. Provide gauge kit for projects requiring over 20 balancing valves. Gauge kits shall be capable of directly reading GPM, or shall include conversion chart from Cv and pressure.

2.12 SOLENOID VALVES:

- A. Full port, bronze body, malleable iron coil enclosure, stainless steel plunger, valve stem, bonnet tube, and spring, Buna-N seal, rated for 500 psi. See drawings for voltage, size and position (NC or NO).
- B. Manufacturer: Magnetrol Figure No. 200-A, ASCO, Skinner,

PART 3 EXECUTION

3.1 GENERAL VALVE INSTALLATION REQUIREMENTS:

- A. Install valves such that operator is completely operable.
- B. Orient axis of valve stems so that in the event of stem packing leakage, fluid will not drip or run on pipe(s) below. Example: rotate valves on horizontal pipe 45° from vertical.
- C. Butterfly valves shall not be mounted with the stem axis in the vertical position. Unless space or operational constraints dictate otherwise, position stems at least 45° from vertical and orient valve so the lower portion of the disk opens in the direction of flow.
- D. Service and tighten all packing glands on valves so equipped so there is no leakage. Replace defective packing.
- E. Install drain cocks in all locations indicated on plans and in all additional locations necessary to allow complete system drainage.
- F. Identify and turn over any loose valve keys or operators.

3.2 SOLENOID VALVE INSTALLATION REQUIREMENTS:

- A. Provide a strainer before each solenoid valve. Provide a water hammer arrestor upstream of solenoid valves used for water service.

3.3 NATURAL GAS VALVE INSTALLATION REQUIREMENTS:

- A. Install valves in accessible locations, protected from physical damage. Do not locate valves in plenum ceilings.
- B. Install isolation valve upstream and within 6 feet of gas appliance. Install a union or flanged connection downstream from the valve to permit removal of controls.

3.4 DOMESTIC HOT WATER VALVE INSTALLATION:

- A. Refer to Sections 232216 and 221119 for gasket requirements on domestic water system valves.

END OF SECTION 220523

SECTION 220548 – VIBRATION CONTROL

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, Standard General and Supplementary General Conditions, Division 1 Specification Sections, and other applicable Specification Sections including the Related Sections listed below, apply to this Section.

1.2 SCOPE OF WORK:

- A. Provide vibration control items for isolating vibration of mechanical equipment, piping and ductwork.
- B. Provide all hangers, isolators, bases, pads, sleeves and other devices specified, required, or detailed for the project. Include all vibration isolation system elements as recommended by the equipment manufacturer's representative to make a complete, correct and safe installation. Supply and install all incidental materials needed.

1.3 QUALITY ASSURANCE

- A. Work of this section shall be performed by skilled workers who are experienced in the necessary crafts to meet the requirements of this Section.
- B. Provide field supervision and inspection to assure proper installation, adjustment and performance. Replace any isolators that are found to resonate with the supported equipment.
- C. As a minimum provide vibration control per ASHRAE - 1995 - HVAC Applications, Chapter 43 - "Sound and Vibration Control".
- D. Isolators shall be selected, installed and adjusted to prevent the transmission of objectionable vibration and noise to the building structure.
- E. The size and number of mounts and hangers shall be chosen to meet these specifications, even if not specifically shown on the plans. Brackets, rails, bases, braces, etc., shall be provided as needed for a complete and correct installation.

1.4 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, manufacturers for products specified in this Section shall be one of the following:
 - 1. Vibration Eliminator Co.
 - 2. Mason Industries, Inc.
 - 3. Korfund Dynamics Co.
 - 4. Vibration Isolation Co.

1.5 COORDINATION

- A. The Contractor shall coordinate with the supplier of vibration isolation equipment to ensure isolators are sized for the actual equipment supplied.

PART 2 PRODUCTS

2.1 FLEXIBLE DUCT CONNECTIONS

- A. Flexible sleeves for duct connections shall be fabricated from flexible, airtight, coated fabric. Each sleeve shall be installed with at least 3 inches slack across a clear metal to metal gap of at least 4 inches. That is, 7 inches of this fabric is required for each sleeve.

2.2 INERTIA BASES

- A. Inertia bases fabricated from steel or concrete shall be provided for fans and pumps as described below.
- B. All mounts shall have leveling bolts rigidly secured to the equipment being isolated.
- C. Base Type CIB
 - 1. Inertia base Type CIB (Concrete Inertia Base) shall have an integral rectangular structural steel form into which concrete is poured. Perimeter members shall be beams of depth equal to 10% of the longest span of the base, but not more than 12 inches nor less than 6 inches deep. Forms shall include motor slide base and all reinforcing steel. Where anchor bolt locations fall in concrete, the reinforcing steel shall include drilled members with sleeves welded below the steel to accept the anchor bolts. Height saving steel brackets shall be used in all mounting locations.
 - 2. When the concrete base is "T" shaped, isolators shall be located under the projections as well as under the main body in order to prevent cantilever distortion.
 - 3. Base Type CIB shall be Mason Industries Type KSLFSW or approved equal.
- D. Base Type SIB
 - 1. Inertia base Type SIB (Steel Inertia Base) shall be a structural steel base frame with clearance holes located to correspond to the mounting bolt holes of the equipment mounted on the base.
 - 2. Bases shall have built-in motor slide rails and shall be reinforced as necessary to withstand belt pull without drive misalignment or base distortion. The bases shall be constructed with deep angle steel sections with a minimum vertical angle leg of 4 inches for motors of 7.5 hp or less, 5 inches for motors between 7.5 hp and 20 hp and 6 inches for motors over 20 hp.
 - 3. Base Type SIB shall be Mason Industries Type WFSLFSW, or approved equal.

2.3 VIBRATION ISOLATORS

- A. The static deflection of isolators shall be as specified below and in ASHRAE - 1995 Chapter 43.
- B. Vibration isolator sizes and layout shall be determined by the vibration isolator supplier.
- C. Isolator Type WP
 - 1. Type WP (Waffle Pads) shall be 5/16 inch thick neoprene pads ribbed or waffled on both sides. The pads shall be manufactured with bridge bearing quality neoprene and selected for a maximum durometer of 50 and designed for 15% strain. Where required, steel load-spreading plates shall be incorporated between the equipment and the neoprene pad.
 - 2. If the isolator is bolted to the structure, a neoprene mounting sleeve shall be installed under the bolt head between the steel washer and the base plate.
 - 3. Type WP pad shall be Mason Industries Type W or approved equal.
- D. Isolator Type MWP
 - 1. Type MWP (Metal and Waffle Sandwich Pads) shall consist of two or more 5/16 inch thick ribbed or waffle neoprene pads sandwiching a 16 gauge stainless steel shim plate. The pad shall be manufactured with bridge bearing quality neoprene and selected for maximum durometer of 50 and designed for 15% strain.
 - 2. If the isolator is bolted to the structure, a neoprene mounting sleeve shall be installed under the bolt head between the steel washer and the base plate.
 - 3. Type MWP pad shall be Mason Industries Type WSW or approved equal.
- E. Isolator Type DDNM

1. Type DDNM (Double Deflection Neoprene Mounts) shall be laterally stable, double deflecting, molded neoprene isolators. All metal surfaces shall be covered with neoprene. The top and bottom surfaces shall be ribbed and bolt holes shall be provided in the base. The mounts shall have a leveling bolts rigidly secured to the equipment.
2. The isolator shall be manufactured with bridge bearing quality neoprene and selected for a maximum durometer of 50 and designed for 15% strain. DDNM mounts shall be selected for a static deflection of 3/8 inch unless otherwise specified.
3. Type DDNM mount shall be Mason Industries Type ND or approved equal.

F. Isolator Type DDNH

1. Type DDNH (Double Deflection Neoprene Hangers) shall consist of a molded neoprene isolating element in a steel hanger box. A neoprene sleeve shall be provided where the lower hanger rod passes through the steel hanger box, such that the hanger rod cannot contact the steel hanger. The diameter of the clear hole in the hanger box shall be at least 3/4 inch larger than the diameter of the hanger rod and permit the hanger rod to swing through a 30° arc. When installed, the hanger box shall be allowed to rotate through a full 360° without encountering any obstructions.
2. The isolator shall be manufactured with bridge bearing quality neoprene and selected for a maximum durometer of 50 and designed for 15% strain. Unless otherwise specified, the static deflection of DDNH hangers shall be 0.3 inches.
3. Type DDNH hanger shall be Mason Industries Type HD or approved equal.

G. Isolator Type SPNM

1. Type SPNM (Spring and Neoprene Mounts) shall have a free-standing and laterally stable steel spring without any housing. Springs shall be designed so that the ratio of the horizontal to vertical spring constant is between one and two. The spring diameter shall be not less than 80% of the compressed height of the spring at rated load. Loaded springs shall have a minimum additional travel to solid equal to 50% of the specified static deflection.
2. Unless otherwise specified, the minimum static deflection of SPNM isolators for equipment mounted on grade slabs shall be 1 inch and for the minimum static deflection for equipment mounted above grade level shall be 2 inches.
3. Two Type WP isolation pads sandwiching a 16 gauge stainless or galvanized steel separator plate shall be bounded to the isolator baseplate.
4. Unless otherwise specified, isolators need not be bolted to the floor for indoor installations. If the base plates are bolted to the structure, a neoprene mounting sleeve shall be installed under the bolt head between the steel washer and the base plate.
5. Type SPNM mount shall be Mason Industries Type SLFSW or approved equal.

H. Isolator Type SPNH

1. Type SPNH (Spring and Neoprene Hangers) shall consist of a steel spring in a series with a neoprene isolating element. The spring shall have a minimum additional travel to solid equal to 50% of the specified deflection. The neoprene element shall have a static deflection of not less than 0.3 inches with a strain not exceeding 15%.
2. Unless otherwise specified, the static deflection of SPNH hangers shall be 2 inches.
3. Spring diameter and hanger box hole size shall be large enough to permit the hanger rod to swing through a 30° arc. A neoprene sleeve shall be provided where the lower hanger rod passes through the steel hanger box, such that the hanger rod cannot contact the steel hanger. The diameter of the clear hole in the hanger box shall be at least 3/4 inch larger than the diameter of the hanger rod. When installed the spring element shall not be cocked and the hanger box shall be allowed to rotate through a full 360° arc without encountering any obstructions.
4. Type SPNH hanger shall be Mason Industries Type 30N or approved equal.

2.4 FLEXIBLE PIPE CONNECTORS

- A. Flexible connectors for pipes shall be neoprene Mason Type MFNEC, MFTNC or as approved.

PART 3 EXECUTION

3.1 GENERAL

- A. All equipment mounted on vibration isolators shall have a minimum operating clearance of 2 inches between the bottom of the equipment or inertia base (and height saving bracket) and the concrete housekeeping pad (or bolt heads) beneath the equipment.
- B. Check the clearance to ensure that no scraps have been left to short circuit the vibration isolators.
- C. Provide a minimum of 4 inches between isolated equipment and the walls, ceiling, floors, columns and any other equipment not installed on vibration isolators.
- D. Piping, ductwork, conduit or mechanical equipment shall not be hung from or supported on other equipment, pipes, or ductwork installed on vibration isolators.
- E. Equipment connected to water or other fluid piping shall be erected on isolators or isolated foundations at correct operating heights prior to connection of piping. Equipment should be blocked-up with temporary shims to final operating height. When the system is assembled and fluid is added, the isolators shall be adjusted to allow removal of the shims.
- F. All mechanical equipment not specifically identified in this specification that contains rotating or vibration elements shall be installed on Type DDNM neoprene isolators as appropriate. Provide supporting steel structure between isolators and equipment if isolator does not readily connect to equipment.

3.2 BASE MOUNTED PUMPS

- A. Base mounted pumps shall be bolted and grouted to prefabricated, Type CIB reinforced concrete inertia bases, which shall weigh not less than 1.5 times the combined weight of the fluid filled pump(s) and motor(s). The minimum thickness of the concrete base shall be 6 inches. Any rigid pipe elbows at the pump suction and discharge connections shall be supported from the inertia base. The inertia base shall be supported on at least four (4) Type SPNM isolators.
- B. All pipe connections to pumps shall be with a flexible connector.

3.3 FAN ISOLATION - GENERAL

- A. Fans and air handlers shall be mounted on vibration isolators as described herein.
- B. Fans and air handling units shall be leveled with the fans operating before the flexible connectors are attached.
- C. All fan bases and isolators shall be sized so that thrust restraints (which would act against turning moment caused by static pressure) are not required.
- D. Fan plenums, air mixing plenums and package air handler plenums shall be installed on a solid base with a continuous Type WP neoprene isolator at the entire perimeter of the base.
- E. Coils and filters in built-up air handling units shall be supported on Type MWP neoprene pads. Any remaining gap beneath the coil/filter frame shall be sealed airtight with approved non-hardening acoustical sealant.
- F. Fans or air handling units and their respective isolators shall be directly mounted on primary steel. Units and isolators shall not be mounted on resiliently supported steel cabinets or plenum floors or other flexible construction.

3.4 FLOOR MOUNTED FANS AND AIR HANDLING UNITS

- A. Each floor mounted fan and fans within package air handling units shall be mounted on a Type CIB base with Type SPNM isolators.
- B. Drain pipes for air handling units shall be supported only from the isolated air handling unit frame. The condensate shall drip into a funnel that is supported from the floor or floor drain.

3.5 ROOF MOUNTED FANS

- A. Roof mounted fans or roof top units shall be installed on a curb mounted base.

3.6 EXPANSION TANKS AND HEAT EXCHANGERS

- A. Each floor mounted unit shall be supported on Type MWP neoprene sandwich pads.
- B. Each suspended unit shall be supported on Type DDNH hangers.
- C. Where piping on isolators is connected to the units the connections shall be made with a neoprene flexible connector.

3.7 PIPES CONNECTED TO EQUIPMENT ON SPRING ISOLATORS

- A. Pipes connected to equipment installed on spring vibration isolators shall be suspended, supported and guided by means of appropriate spring vibration isolators. This includes hot water heating, steam and chilled water, etc. Pipes shall be supported by Type SPNM isolators or hung from the structure on type SPNH isolators.
- B. The first two hangers both upstream and downstream of equipment shall be spring isolators having a static deflection of 1 inch.

3.8 PIPES CONNECTED TO EQUIPMENT ON NEOPRENE ISOLATORS

- A. Piping in the Mechanical Equipment Room that is connected only to machinery installed on neoprene isolators shall be either supported from the floor on Type DDNM mounts or suspended from the structure on Type DDNH hangers.

3.9 PIPES WITH MULTIPLE CONNECTIONS

- A. Where a pipe run connects multiple items of equipment in the Mechanical Room the pipe isolators for the entire run shall be chosen to suit the connected equipment of greatest static deflection.

3.10 FLEXIBLE CONNECTORS

- A. A neoprene flexible hose shall be installed to connect a pipe on isolators to a piece of equipment on isolators of less static deflection than the pipe.

3.11 ELECTRICAL CONNECTION

- A. All wiring connections to mechanical equipment on vibration isolators (either spring or neoprene type) shall be made with a minimum 36 inch long flexible conduit in a 360° loop. Coordinate wiring connections with the Electrical Installer.

3.12 INSPECTION

- A. Supplier shall inspect and approve the installation of the vibration isolators and shall submit a report to the Owner which verifies that all of the isolation equipment has been properly installed and that the installation is in full conformance with the specification. The report shall record the vibration isolator identification and model or type.
- B. For isolators containing steel springs the report shall also record the size and uncompressed height, design static deflection and measured static deflection of the isolators provided.

END OF SECTION 220548

SECTION 220553 – MECHANICAL IDENTIFICATION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, Standard General and Supplementary General Conditions, Division 1 Specification Sections, and other applicable Specification Sections including the Related Sections listed below, apply to this Section.

1.2 SCOPE OF WORK:

- A. Provide mechanical identification on piping, ductwork and equipment.

1.3 QUALITY ASSURANCE

- A. Comply with ANSI A13.1 for lettering, size, colors, and viewing angles of mechanical identification.

1.4 ACCEPTABLE MANUFACTURERS:

- A. Provide mechanical identification materials from one of the following:
1. Brimar Identification and Safety Products
 2. Seton Name Plate Corp.
 3. Or approved equal.

PART 2 PRODUCTS

2.1 PIPE MARKERS:

- A. Manufacturer's standard, pre-printed, color-coded, plastic pipe markers, complying with ANSI A13.1, and requirements below. Self-adhesive markers are not acceptable.
- B. For pipe diameter (with insulation) less than 6": full-band, semi-rigid, snap-on pipe markers, extending 360 degrees around pipe.
- C. For pipe diameter (with insulation) of 6" and larger: full-band or strip-type pipe markers, but not narrower than 3 times letter height. Fasten with nylon or stainless steel bands for pipe 6" through 12". Fastened with stainless steel bands for piping over 12".
- D. Lettering: Standard nomenclature which best describes piping system, as selected by Engineer (in cases of variance from table below).
- E. Arrows: Pipe marker arrows indicating direction of flow, either integrally with piping system lettering, or as a separate marker.
- F. Use the following color coding and nomenclature for pipe markers:

Plumbing and Waste Pipe System Labels	Drawing I.D. (For Reference Only)	Letter and Label Color
Cold Water, Potable	CW	White on Green
Fire Protection	FP	White on Red
Hot Water Supply, Potable	HW	Black on Yellow
Hot Water Return, Potable	HWR	Black on Yellow
Natural Gas	G	Black on Yellow
Non-Potable Water	NPW	Black on Yellow
Sanitary Vent	V	White on Green
Sanitary Waste	SS	White on Green

Plumbing and Waste Pipe System Labels	Drawing I.D. (For Reference Only)	Letter and Label Color
Soft Cold Water	SCW	White on Green
Storm Sewer Water	ST	White on Green

2.2 DUCT MARKERS:

- A. Plastic, adhesive type color-coded duct markers, with arrow indicating direction of flow, and with fan system identified. Conform to the following color code and nomenclature:

Service/ Duct Label	Drawing I.D. (For Reference Only)	Letter and Label Color
Supply Air (Equip.#)	SA (Eq.#)	White on Green
Return Air (Equip.#)	RA (Eq.#)	White on Green
Exhaust Air (Equip.#)	EA (Eq.#)	Black on Yellow
Outdoor Air (Equip.#)	OA (Eq.#)	White on Green

- B. Provide plastic adhesive duct access door markers indicating item and associated equipment accessed, and appropriate safety and procedural information. (eg. Fire Damper AHU-1)

2.3 EQUIPMENT MARKERS:

- A. Engraved plastic equipment markers for all scheduled equipment, (eg. Water heaters, pumps, air handling units, heat exchangers, and fans). Indicate drawing I.D. (on schedule), and service, (eg., Exhaust Fan, EF-1), nominal capacity (tons, cfm or gpm). Scale marker and lettering to equipment labeled, 1/2" high letters minimum. Typical nomenclature:

Drawing I.D. & Equip. Label 	Equipment
ACC	Air Cooled Condenser
AHU	Air Handling Unit
BLR	Hot Water Boiler
CU	Condensing Unit
ECH	Cabinet Unit Heater
EF	Exhaust Fan
EH	Electric Heater
FC	Fan Coil Unit
HX	Heat Exchanger
HWHP	Hot Water Heating Pump
MAU	Make-Up Air Unit
P	Pump (other than those listed)
PTAC	Packaged Terminal Air Conditioner
RF	Return Fan
SF	Supply Fan
UH	Unit Heater
VAV	Variable Air Volume Box
WH	Water Heater

2.4 IDENTIFICATION ACCESSORIES:

- A. Underground Pipe Markers: Manufacturer's standard, permanent, bright-colored plastic tape, intended for direct-burial service, 6" wide x 4 mils thick, continuously printed to indicate service of buried pipe.
- B. Valve Tags: 1-1/2" diameter brass valve tags with 1/4" stamp-engraved designations with piping system abbreviation and sequenced valve numbers. Provide solid brass chain, or solid brass S-hooks of the size and type required for proper attachment of tags to valves.

- C. Architectural Access Panel Markers: 1/16" thick engraved plastic laminate, with nomenclature corresponding to items for which access door was installed.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS:

- A. Coordination: Install identification after insulation is applied. Protect identification from paint, or apply after painting is complete. Install above ceiling identification prior to acoustical ceilings.
- B. Attachment: Securely attach all mechanical identification to associated pipe, duct, panels and equipment. Locate identification to be readily visible.

3.2 PIPING SYSTEM IDENTIFICATION:

- A. Install pipe markers on all piping systems in spaces where piping is exposed, concealed only by removable ceiling system, and where accessible at manholes and access panels.
- B. Locate pipe markers near points where piping continues into shafts, underground, floor or wall; at 25' spacing along exposed runs (15' in congested areas), at valves, equipment and control devices, and where there could be question of flow pattern.
- C. Install marker over pipe insulation segment on hot non-insulated pipes.

3.3 DUCTWORK IDENTIFICATION:

- A. Install duct markers on all supply, return, exhaust, intake and relief ductwork where duct is exposed, concealed only by removable ceiling system, and where accessible at access panels.
- B. Locate duct markers near points where ductwork originates or continues into shafts, floor or wall, and at 25' spacing along exposed runs.
- C. Install duct access door markers on all access doors.

3.4 EQUIPMENT IDENTIFICATION:

- A. Provide equipment markers on scheduled equipment.

3.5 ARCHITECTURAL ACCESS PANEL IDENTIFICATION:

- A. Install access panel markers on inside of access doors.

END OF SECTION 220553

SECTION 220700 – INSULATION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, Standard General and Supplementary General Conditions, Division 1 Specification Sections, and other applicable Specification Sections including the Related Sections listed below, apply to this Section.

1.2 SCOPE OF WORK:

- A. Insulate piping and equipment unless indicated as not to be insulated in paragraph 1.4.
- B. Insulate connection points between new and existing items.
- C. Repair or replace insulation damaged during construction.

1.3 SUBMITTALS

- A. Provide manufacturer's literature and ratings for all pipe and duct insulation products. Data shall include fire and smoke ratings, thermal conductivities, recommended temperature limitations, perm ratings of jackets and materials of construction.
- B. Submittals shall be clearly marked to indicate what insulation and cover is to be used, insulation thickness and which system is to be insulated with each product.

1.4 ITEMS NOT TO BE INSULATED:

- A. Equipment: hot water pumps, feed water pump, water softener shell, vacuum pumps, hot water shot feeders, hot water expansion tanks, factory insulated equipment.
- B. In hot piping: Unions, flexible connectors, control valves 2" and smaller, safety valves, discharge vent piping, vacuum breakers, thermostatic vent valves, and steam traps 3/4 inch and smaller.
- C. Other piping: waste and vent, compressed air, natural gas, lab vacuum, refrigerant liquid lines, vertical portion of rain water conductors.
- D. Ductwork: indoor return air ductwork in conditioned areas, exhaust air ductwork.

1.5 FIRE RATINGS

- A. All products used shall be UL listed with a maximum flame spread rating of 25 and maximum smoke development rating of 50.

PART 2 PRODUCTS

2.1 GENERAL INSULATION DEFINITIONS:

- A. Insulation thermal conductivity: No greater than value listed, in Btu-inch/hour-square foot-degrees F at 75 degrees F mean temperature.
- B. Water Vapor Permeance (ASTM E97 or E96, Procedure A): No more than value listed, in perms. Water vapor permeability (ASTM C355): No greater than value listed, in perm-inch.
- C. Puncture resistance (ASTM D781): No less than value listed.
- D. Flame spread classification (ASTM E84, NFPA 255): No greater than value listed. Smoke density classification (ASTM E84, NFPA 255): No greater than value listed. Composite listing includes insulation, jacket, and adhesive.
- E. Density no less than value listed, in pounds per cubic foot.

2.2 ACCEPTABLE PRODUCTS

- A. Equivalent products of Armstrong, Johns-Manville, Knauf, Certainteed, K-FLEX, and Owens-Corning are acceptable.
- B. Substitute insulation shall provide same thermal and mechanical protection as the insulation specified.

2.3 PIPING INSULATION THICKNESS TABLE:

- A. Minimum insulation thickness in inches, shall comply with the table below for the associated piping system and pipe sizes. Overall conductance shall comply with ASHRAE 90.

Piping	Temp.	Thickness in Inches For Pipe Sizes							
System	Range	Through Size Listed							
Fluid	Deg. F	1"	2"	4"	6"	8"	10"	& above	
Hot Water	110-200	1.0	1.0	1.5	1.5	1.5	1.5		
(above includes domestic and heating)									
Cold Water	Any	0.5	0.5	0.5	1.0	1.5	2.0		
Storm	Any	0.5	0.5	1.0	1.5	1.5	1.5		
Chilled W.	Any	0.5	1.0	1.0	1.0	1.0	1.5		
Ref. Suct.	Any	1.0	1.5	1.5	N/A	N/A	N/A		
Energy									
Recovery	Any	1.0	1.0	1.0	1.0	1.0	1.0		
Condensate	Any	0.5	N/A	N/A	N/A	N/A	N/A		

- B. For heat traced piping use insulation ¼" diameter larger to allow room for installation of cable.

2.4 PIPING INSULATION - INDOOR (FIBERGLASS):

- A. Insulate with fiberglass insulation with factory-applied vapor barrier jacket with self-sealing laps. ASTM C547 Class 1 insulation, conductivity of 0.26. Vapor barrier jacket: laminated white kraft paper, aluminum foil, glass fiber reinforcement, permeance of 0.2 perms, and puncture resistance of 50 units. Composite flame spread/ smoke density of 25/50. Apply insulation in thickness listed in Insulation Thickness Table listed in paragraph 2.2.
 - 1. Manufacturers: Johns-Manville (Micro-Lok 650 AP-T), Knauf (ASJ-SS1 Pipe Insulation), Owens/Corning (Fiberglass ASJ/SSL-II)
- B. At fittings and flanges, insulate with wrapped fiberglass insulation of same thickness as adjacent pipe, and cover with pre-molded PVC jackets. Seal edge of jacket with self-sealing vapor barrier tape.
 - 1. Jacket Manufacturer: Zeston, Ceeco, Proto
- C. For valves, strainers, suction diffusers and other accessories that require maintenance: In hot piping, insulate similar to fittings and flanges. In cold piping, insulate with closed cell elastomeric insulation, installed to be removable for maintenance access.
- D. Wherever necessary to seal insulation and provide a complete and continuous vapor barrier, apply two coats of insulating mastic Manufacturers: Celotex - MW-1 Insulating and Finishing Cement; Pabco - Pabcote One Coat Insulating Cement.

2.5 PIPING INSULATION (CLOSED CELL ELASTOMERIC):

- A. Copper condensate drainage piping shall be insulated with flexible closed cell elastomeric foam insulation, ASTM C534, conductivity of 0.258 (90F), water vapor permeability of <0.01 perm-in. In thickness 2" and less, composite flame spread/ smoke density of 25/50.. Manufacturer: K-FLEX INSUL-TUBE, black or white.
- B. As a Contractor's Option to paragraph 2.4, insulate hot water, cold water, refrigerant, and condensate piping systems as described in 'A' above.
- C. Apply insulation in thickness listed in table in paragraph 2.3. Seal all butt joints and seams by joining cut edges with contact adhesive as supplied by the insulation manufacturer.

2.6 PIPING INSULATION SPECIALTIES:

- A. Aluminum Jackets: Where indicated on drawings, provide 0.016" thick alloy 3003 aluminum jacketing with longitudinal lock seam and butt strap circumferential joints. Manufacturers: Childers-Lock-on and Pabco-Surfeit.
- B. Removable Insulation Jackets: Where indicated on drawings, provide removable insulation jackets with fiberglass insulation, flexible fabric jacket and velcro fasteners. Manufacturer: ESI - Q Master; Insulation Technologies Inc.

2.7 HOT EQUIPMENT INSULATION:

- A. Insulate all equipment with surface temperature over 100F, using rigid fiberglass insulation board. Insulation: ASTM C612 Class 2, conductivity of 0.26, density of 6.0. Vapor barrier: laminated white kraft paper, aluminum foil, glass fiber reinforcement, permeance of 0.2, and puncture resistance of 50 units. Composite flame spread/ smoke density of 25/50.
- B. Manufacturers: CertainTeed - IB600 ASJ Industrial Insulation Board; Schuller - Type 817 Ap Spin-Glas; Knauf - 6PCF-ASJ Insulation Board; Owens/Corning - Type 705 ASJ-25 Fiberglas Insulation
- C. Apply insulation in thickness as follows: 1-1/2" for operating temperature up to 150F, 2" for operating temperature of 150F to 200F, 3" for operating temperature over 200F.
- D. Cut, score, or miter insulation to fit contour of equipment and secure with galvanized steel bands or wire, or weld pins. Stagger joints where possible and fill voids with insulating cement. Apply 1" galvanized wire mesh over entire exterior surface and finish with two coats of insulating cement troweled to a hard finish.

2.8 COLD EQUIPMENT INSULATION:

- A. Insulate all equipment with surface temperature below 60F with 1" thick, flexible, closed cell, elastomeric foam insulation sheet. Manufacturers: K-FLEX INSUL-SHEET
- B. Insulation: ASTM C534, conductivity of 0.235 (32F), permeance of <0.01 perm-in, composite flame spread/ smoke density of 25/50..
- C. Apply elastomeric foam insulation sheet with contact adhesive. Manufacturers: K-FLEX. Seal all butt joints with contact adhesive.

PART 3 EXECUTION

3.1 INSULATION INSTALLATION

- A. All systems shall be tested and approved before being insulated.
- B. The insulation shall be applied over clean, dry surface.
- C. Insulate all valves, flanges, couplings and fittings. Valve and flange insulation shall be removable and re-installable.
- D. Full lengths of insulation shall be used except at end of straight sections and as required to accommodate fittings. Insulation shall be applied with the joints tightly fitted together. Cracks or voids shall be filled with insulation. Manufacturer's recommended installation procedures shall be strictly adhered to.
- E. The edges and seams at all visible locations shall be finished in a neat and workmanlike manner.
- F. Termination of insulation at equipment, unions, etc., shall be neat without any raw edges. Bevel insulation and cover each end the same as a fitting.
- G. Vapor barrier jackets on all cold and dual temperature pipes shall be continuous. Repair all punctures, flaps, etc., correctly and effectively.
- H. Pipe Insulation

1. Provide heavy density Fiberglass insulation, cork or Kaylo block under pipe where insulation saddles are specified with pipe hangers. (See Section 220548). Note: Wood blocking is not acceptable for this purpose.
2. Insulate hot water, cold water, and the waste piping under all lavatories indicated for use by the handicapped.
3. Insulation exposed to the outdoors requires metal jacketing or a suitable protective coating as recommended by the manufacturer.
4. Insulate roof drain basins and all roof drain piping located at or above the floor level of the top floor.

I. Metal Jacket

1. Apply with minimum 1" overlap at seams. Sheet metal screws max. 8" o.c. Seams shall lay at weather protected side of surface, sealed with appropriate sealant in direction to sheet moisture. Final appearance of jacket to be neat without dents, twists, and with seams straight.

J. Existing Insulation

1. Where existing piping and equipment are removed or connected to and the existing insulation is damaged, the Contractor shall repair all existing insulation and jacketing to match the new insulation.

K. Finished installation shall provide a continuous and effective vapor barrier.

L. Refer to details on drawings.

END OF SECTION 220700

SECTION 221113 – PIPING MATERIALS AND METHODS

PART 1 GENERAL

1.1 GENERAL

A. RELATED DOCUMENTS

1. Drawings and general provisions of the Contract, Standard General and Supplementary General Conditions, Division 1 Specification Sections, and other applicable Specification Sections including the Related Sections listed below, apply to this Section.

1.2 SCOPE OF WORK:

- A. This Section specifies piping materials and installation methods common to more than one section of Division 21, 22, and 23 and includes joining materials, piping specialties, and basic piping installation instructions.

1.3 SUBMITTAL DATA

- A. Provide submittal data for any material or equipment specified in this section.

1.4 QUALITY ASSURANCE:

- A. All building service piping (including pressurized piping, vacuum), shall comply with ANSI Standard B31.9 - Building Service Piping, unless noted otherwise.

PART 2 PRODUCTS

2.1 GENERAL PIPING REQUIREMENTS:

- A. All piping materials shall be compatible for temperature, pressure and service.
- B. All piping materials of a given type shall be manufactured by a single source, and supplied by a single supplier.
- C. All wetted seals shall be made from materials that are immune from chloramine degradation.

2.2 PLUMBING PIPING SYSTEMS:

A. Domestic Cold Water, Hot Water and Hot Water Return - Above Ground:

1. For piping through 6":
 - a. Pipe: Type L Copper, hard drawn, ASTM B 88
 - b. Fittings: Wrought Copper, ANSI B16.22
 - c. Joints: Soldered through 2"; Brazed for 2-1/2" through 6".
2. Contractor Options:
 - a. For piping 2-1/2" through 6", excluding inaccessible areas and shafts, Grooved Joints - for Copper Piping may be used.
 - b. For piping through 4", Copper press to connect fittings may be used.
 - c. For piping through 3", PEX-a piping conforming to ASTM F876 & ASTM F877. Piping system shall be equipped with fittings certified to ASTM F1960 and piping shall be marked accordingly. (Mechanical rooms and exposed piping shall be copper. Run-out and branch piping may be PEX-a.) Installed in accordance with the manufacturer's installation instructions. See Specification Section 221116.

B. Natural Gas - Above Ground:

1. For piping through 2":

- a. Pipe: Black Steel, Schedule 40, ASTM A 53, ERW or seamless, grade B
 - b. Fittings: Malleable iron, 150 lb. ASTM A 197; unions, 250 lb. ASTM A 197
 - c. Joints: Screwed Terminal connections 1/2" and less: Type L Copper, annealed, ASTM B 88, 24" maximum length, flared connections
- 2. For piping 2-1/2" and larger
 - a. Pipe: Black Steel, Schedule 40, ASTM A 53, ERW or seamless, grade B, standard weight for 12" and above
 - b. Fittings: Standard weight, butt welded, black steel, ASTM A 234
 - c. Joints: Welded. Flanged ASTM A 181, 150#, forged steel at valves, and equipment.

C. Sanitary Waste and Vent - Above and Under Ground:

- a. Pipe: Cast Iron, Service Weight, CISPI Standard 301, ASTM A74, ASTM C564
- b. Fittings: Cast Iron, drainage pattern, ASTM A74, ASTM C564
- c. Joints: No-Hub, Heavy Duty clamps

D. Sanitary Waste and Vent – Above and Under Ground, where approved by local authority and codes.

- a. Pipe: PVC Schedule 40, ASTM D 2665, NSF approved, type DWV
- b. Fittings: PVC, ASTM D 3311
- c. Joints: Screwed or solvent weld, ASTM D2564

E. Cooling Coil Condensate Waste and Equipment Drains - Above Ground:

- a. Pipe: Type DWV Copper, hard drawn, ASTM B306
- b. Fittings: Wrought Copper, ANSI B16.22
- c. Joints: Soldered.

F. Storm - Above and Under Ground:

- a. Pipe: Cast Iron, Service Weight, CISPI Standard 301, ASTM A74, ASTM C-564
- b. Fittings: Cast Iron, drainage pattern, ASTM-A74, ASTM C564
- c. Joints: No-Hub

G. Storm – Above and Under Ground:

- a. Pipe: PVC Schedule 40, ASTM D-2665, NSF approved, type DWV
- b. Fittings: PVC, ASTM D-3311
- c. Joints: Solvent welded, ASTM D-2564

2.3 SPECIAL PIPING SYSTEMS:

A. Refrigeration Piping - Above Ground and Under Ground:

- a. Pipe: Type L or K Seamless Copper, Nitrogenized ACR, ASTM B 88 or ASTM B 280, annealed for 3/8" and smaller, hard drawn for 1/2" and larger. For underground piping 2" and smaller: Type K, annealed, with no fittings.
- b. Fittings: ANSI B16.26 cast copper alloy refrigeration type with 45 degree flare or wrought copper ANSI B16.22 socket fittings
- c. Joints: brazed, flared (above ground only).

2.4 PIPE JOINTS:

A. Soldered Joints: ASTM B32; Alloy Sb5, (95% Tin, 5% Antimony). Unless noted otherwise, joints may be screwed or flanged to suit valves and equipment. Manufacturers: Engelehard "Silverbrite 100", Harris "Bridgit" No self-cleaning fluxes allowed.

- 1. Type DWV Copper to be 50/50 Solder.
- 2. Underground K copper shall be silver solder.

- B. Brazed Joints:** ASTM B32, silver brazed joints with 1000F minimum melting point, conforming to AWS - A5.8, "Specification for brazing filler metal". Classification BAg-1. Unless noted otherwise, joints may be screwed or flanged to suit valves and equipment. Unless otherwise noted, solder joints near flanges and threads where heat from brazing would anneal or warp flanges or threads. Manufacturers: Lucas-Milhaupt Inc. "Sil-Fos", J.W. Harris "Stay-Silv 15" and "Safety Silv"
- C. Screwed Joints:** Tapered thread, ASME B1.20.1, joined with compatible compound or sealant tape applied to male thread only.
- D. Welded Joints:** Comply with Section II, Part C, ASME Boiler and Pressure Vessel Code for welding materials appropriate for the wall thickness and chemical analysis of the pipe being welded. Pipe and fittings shall be beveled and butt welded.
- E. Grooved Joints - for Copper Piping:** Rolled grooves, center legged peroxide cured EPDM gaskets, Ductile Iron housing (ASTM A 532 or A 536), wrought copper (ASTM B 75, ANSI B16.22) or cast bronze fittings, rated for 300 psi working pressure. System shall be designed for rigid installation. Brazed flanges must be used at equipment connections, and for maintenance removal sections. Clamp-on branch outlets are prohibited. Manufacturers: Victaulic CTS Series, Anvil International Gruvlok 7400 Rigidlite, Tyco Grinnell.
- F. Grooved Joints - for Steel Piping:** Rolled or cut grooves, peroxide cured EPDM gaskets, Ductile Iron coupling and fittings (ASTM A532 or A536), rated for a minimum working pressure of 300 psi, 500 psi for piping 10" and smaller. System shall be designed for rigid installation. Welded flanges must be used at equipment connections, and for maintenance removal sections. Clamp-on branch outlets are prohibited. Manufacturers: Victaulic Style 07, Anvil International Gruvlok 7401 Rigidlok, Tyco Grinnell.
- G. Grooved Joints - for Copper Piping in tunnels:** Rolled grooves, peroxide cured center legged EPDM gaskets, Ductile Iron housing (ASTM A 532 or A 536), wrought copper (ASTM B 75, ANSI B16.22) or cast bronze fittings, rated for 300 psi working pressure. System shall be designed for rigid installation. Brazed flanges must be used at equipment connections, and for maintenance removal sections. Clamp-on branch outlets are prohibited. Manufacturers: Victaulic CTS Series style 606.
- H. Press Joints:** Copper press to connect fittings shall be made in accordance with the manufacturer's installation instructions. Fittings shall conform to the material and sizing requirements of ASME B16.18 or ASME B16.12. O-rings for copper press fittings shall be peroxide cured EPDM. The joints shall be pressed using the tool approved by the manufacturer. Approved fitting, tool, and process: Viega ProPress, NIBCO Press System.
- I. Flanged Joints:** Select materials to suit service of piping, conform to respective ANSI Standards, A21.11, B16.20, B16.21 Gasket material: full-faced for cast-iron flanges and raised-face for steel flanges. Gaskets in steam and condensate lines shall be "FLEXALLIC", 316 L stainless steel with "FLEXICARB" filler
- J. No-Hub Joints:** Stainless Steel band and shield, neoprene rubber gasket. ASTM C 564. Manufacturers: Clamp-All
- K. Solvent Cement Joints:** Select materials suitable for pipe materials joined and compatible with fluid served. Conform to respective ASTM Standards D-2235, D-2564, D-2855 and D-3138.
- L. Gasket Joint Lubricant - for use with grooved and no-hub joints:**
Provide manufacturer's recommended gasket lubricant.

2.5 UNIONS:

A. Steel Pipe

1. Up through 3" - black malleable iron threaded, hexagonal nuts, ground joint (brass to iron seat), flanged unions or flanges.
2. 3-1/2" and Up - ASME flanges, welded to pipe.
3. Victaulic couplings are acceptable as a union.

B. Copper Pipe

1. Up through 3" - cast brass, copper-to-copper, hexagonal nut.
2. 3-1/2" and up - ASME cast brass flanges, soldered to pipe.

C. Copper to Steel Pipe

1. Up through 2" - dielectric unions with soldered or threaded ends to match adjacent piping.
2. 2-1/2" and up - cast brass flange soldered to copper pipe and steel or iron flange welded to steel pipe.

D. Plastic (PVC) to Steel

1. 150# plastic flange with solvent weld hub to standard ASME steel flange.

2.6 PIPE HANGERS AND SUPPORTS:

A. Provide adjustable type pipe hangers, supports and accessories for the proper support of all piping. Figure and model numbers specified on drawings are for Anvil International, and Pipe Shields Inc. Continuous threaded rod shall be used for intermediate attachments. See details on drawings.

1. Bare Steel Pipe - Grinnell Fig. 97 adjustable pipe ring, Fig. 65 clevis or Fig. 260 clevis.
2. Bare Copper Pipe - Grinnell Fig. 97C, Fig. CT-99 or Fig. CT-99C.
3. Cast Iron Pipe - Grinnell Fig. 65 clevis up through 3" size and Fig. 590 clevis for 4" and larger.
4. Plastic Pipe - Same as bare steel.
5. Hangers for insulated pipe shall be Grinnell Fig. 167 protection shield with 65 or 260 clevis. Note that the hanger on insulated pipe must be sized for the insulation diameter. Wood blocking shall not be used to support insulated pipe. See SECTION 220700 for required rigid support insulation materials.

B. Dielectric protection for hangers and supports: Where copper piping is supported with steel hangers and supports, dielectric protection must be provided. Use one of the following means as applicable:

1. Coated hangers (copper or plastic coating)
2. Insulation inserts
3. Cushion clamps
4. Other as approved by Engineer.

C. Trapeze hangers and floor supports which carry more than one pipe shall be spaced according to the smallest diameter pipe.

D. Horizontal load bearing members for more than one pipe shall be constructed of angle iron or manufactured structural channel similar and equal to Unistrut series 1000. The corners of all supports shall be cut or ground to minimize the chance of injury to personnel.

E. Galvanized insulation shields, the same as specified for hangers, shall be installed between the insulation and the support on all insulated piping. Shields shall be secured to the insulation with cloth tape not less than 2" wide or with nylon zip ties.

F. Pipes shall be secured to every other support using U-bolts or clamps.

G. Floor supports shall have vertical members constructed of unistrut or schedule 40 pipe and shall be sturdy enough to withstand substantial overloading, such as would be encountered if a worker stepped on the supported piping. Square steel plates shall be bolted or welded to the base of all vertical supports and shall be secured to the floor with no less than two anchors. Base plates shall be large enough to withstand lateral forces from any direction.

2.7 ATTACHMENTS

- A.** Supports, anchors and guides shall be attached to structural framing members, concrete slabs or masonry walls. Where supports are required between structural framing members, suitable intermediate framing shall be provided.
- B.** Hanger rods shall be the same diameter as the hanger tapping. Use Grinnell Fig. 146 rod, or as approved. All hanger rods to be galvanized.
- C.** Steel beam and joist attachments - Grinnell Fig. 229 beam clamp or Fig. 87 C-clamp with retaining strap.
- D.** Concrete inserts: Unistrut #3300 Series in length as required. Grinnell Fig. CB for single hangers, or as called out on details on plans.
- E.** Use expansion shield bolts for fastening to existing concrete.
- F.** Use wood screws, bolts and lag-bolts for fastening to wood structures.

2.8 BASES

- A.** Concrete bases for vibration control or housekeeping shall be provided for items so noted or wherever indicated on the drawings.
- B.** Bases shall be provided as a part of this DIVISION of the specifications but shall be done in accordance with the requirements of DIVISION 3 - CONCRETE.

2.9 PIPE SLEEVES:

- A.** Furnish and set pipe sleeves per details on drawings.

2.10 DIELECTRIC FITTINGS:

- A.** For pipe 2 inch and less: Provide brass coupling. (Dielectric unions are not acceptable).
- B.** For pipe 2-1/2 inch and larger: Provide flange union with dielectric gasket and bolt sleeves.
- C.** For dielectric connection in grooved piping, use manufacturer's dielectric nipple. Manufacturers: Anvil International Gruvlok Di-Lok Nipple, Victaulic Style 47 Dielectric Waterway

2.11 REDUCERS

- A.** Copper or steel, flanged, threaded, Victaulic or welded, eccentric or concentric as required, to match fittings specified for different piping systems.
- B.** Pipe size changes on following listed systems to be made with reducers.
 - 1. Hydronic Systems - eccentric type on horizontal runs with straight side on top, and concentric type in vertical pipe.
 - 2. Steam - eccentric type on horizontal runs with straight side on bottom, and concentric type in vertical pipe.

2.12 STRAINERS:

- A.** Body shall be bronze, cast steel or cast iron, to match piping materials. Strainers shall be same size as piping, with screwed connections on piping 2" and smaller, and flanged connections on piping 2-1/2" and larger. Where grooved piping is specified, grooved joint strainers may be used. Screen area shall be twice internal area of piping. Pressure rating shall be that of piping system, minimum 125 lb. Provide 3/4" ball valve blow down valve on all strainers 2" and larger.
- B.** For water, steam and condensate service, screen material stainless steel, with maximum openings of 0.033 inches (maximum) for pipes 2" and smaller and 3/64 inch for pipe sizes 2-1/2" and larger.
- C.** For air and gas service, screen material stainless steel, with maximum openings of 0.006 inches (maximum) for pipes 2" and smaller and 0.009 inch for pipe sizes 2-1/2" and larger.

- D. Manufacturers: Armstrong, Anvil International, Keckley, Metraflex, Mueller, Spirax-Sarco, Victaulic, Watts, Yarway.

2.13 FLEXIBLE METAL HOSE CONNECTORS:

- A. Length and end fittings as shown in drawings, with an inner corrugated hose made of type 304, 321, or 316 stainless steel and outer braid made of 304 stainless steel. Manufacturers: Metraflex, Flex Hose Co., Flexonics, Mason.
- B. For copper piping systems, use copper construction braided hoses. Manufacturers: Anaconda, Flex Hose Co., Flexonics, Mason, Metraflex

2.14 FLEXIBLE CONNECTORS (RUBBER):

- A. Flexible connectors with neoprene and nylon type elements, forged steel flanges. Connectors shall be rated at 125 psig working pressure at 120 degrees F EPDM, ultraviolet resistant, hand wrapped, non-molded, multiple arch with control rods. Manufacturers: Mason Industries, Inc. Type SFDEJ, Mercer Rubber Co., Metraflex No. 100-HT-2 or other approved by Flexonics or Flex Hose Co.

2.15 PIPE ANCHORS:

- A. Provide pipe anchors where shown and as detailed on drawings.
- B. Anchors shall be provided wherever necessary or indicated to localize expansion or to prevent pipe rattle or undue strain on piping. Anchors shall consist of steel collars with lugs and bolts for clamping and attaching anchor braces, unless otherwise indicated.

2.16 PIPING TRANSITIONS:

- A. Provide transitions for joining two different types of pipe materials such as cast iron, clay, steel, copper or plastic. Fabricate transitions with bushings capable of resisting normal moisture corrosion.
- B. For copper to steel connections, see "Dielectric Fittings".
- C. Manufacturers: Cann-Tex Industries Division of Harsco Corp., "CT-Adapters", Fernco Joint Sealer Co. "PVC Donut", Joint, Inc., "Caulder".

PART 3 EXECUTION

3.1 GENERAL PIPING INSTALLATION REQUIREMENTS:

- A. Work shall be done in accordance with applicable ordinances and codes. Arrange for inspections.
- B. Install piping to permit complete draining. Provide capped hose end ball drain valves at all low points.
- C. Installed piping shall be free from sagging. Provide for expansion and contraction of piping in an approved and safe manner by means of loops or offsets, where mechanical expansion joints are not specifically called for.
- D. Branch piping shall be valved at the branch connection points.
- E. Provide fittings and specialties necessary to properly interconnect all items and specialties whether or not shown in detail.
- F. Clean and swab-out all piping before installation. Piping left open for extended periods shall be capped.
- G. At joints, the pipe shall be reamed to full inside diameter after cutting. Scale, rust and foreign matter removed before assembly. Contractor note: A minimum of one (1) pipe joint maybe cut out of each system at the A/E discretion. The purpose of which to inspect for proper reaming. The piping will be reassembled by the contractor at no increase of contract cost. If improper reaming is detected, the entire piping system will be rejected.

- H. Lay out pipe lines straight, plumb and in true alignment. Offset as required to avoid interference with other work, to conceal piping, to allow maximum headroom and to avoid interference with windows and doors. Lay out all pipes and establish their levels from bench marks, existing floors or finished grades.
- I. Piping shall be concealed unless indicated otherwise on drawings. Do not conceal piping until it has been inspected, tested, flushed and approved.
- J. Use eccentric reducing fittings to increase or decrease pipe sizes. Bushings are not acceptable. Orient reducers to prevent trapping of water.
- K. Locate groups of pipe parallel to each other, spaced to permit applying insulation and servicing of valves. Install hot and cold water lines at least 6 inches apart. Install piping at least 3 inches clear of electrical conduit and avoid running pipe within 3'-6" of electrical equipment, from floor to ceiling.
- L. Piping requiring insulation shall be run so that adequate clearance is maintained to permit proper insulation. Any piping installed without this clearance must be removed and reinstalled at the Contractor's expense to enable insulation to be applied.
- M. Provision to be made in piping for the installing and connecting of all coils, temperature control valves, wells for gauges and controllers, etc., by this Contractor.
 - 1. On 2-1/2" and smaller pipe, increase pipe size at well so there will be no restriction to flow.
 - 2. On 4" and larger steel pipe, a fitting similar and equal to victaulic 'Vic-o-let' will be acceptable for misc. drains and instrument well inserts.
- N. Pipe extending into finished areas shall have chrome plated escutcheons large enough to cover pipe sleeves and shall fit snugly over pipe or insulation.
- O. Pitch piping as follows:
 - 1. Vent piping back toward waste at 1/8" per foot
 - 2. Waste piping down in direction of flow at 1/4" per foot. Never less than 1/8" per foot.
 - 3. Condensate piping down in direction of flow at 1/8" per foot.
 - 4. Natural gas piping level or at 1/4" per 15 feet toward drip leg.

3.2 UNDERGROUND PIPING INSTALLATION REQUIREMENTS:

- A. Piping below grade running through basement walls shall be run through sleeves per details in the plans.
- B. Record as-built sketches and dimensions prior to backfilling.

3.3 WELDING:

- A. All welding shall be performed by registered welders qualified to perform welding operations in accordance with the National Certified Pipe Welding Bureau's procedures and standards, ASME Code Standards and the HPACCNA Standard Manual of Welding.
- B. Submit a certified copy of "Record of Pipefitter Welder Performance Qualification Test" of any of his employees who will be doing welding on this project.
- C. No welding to building work shall be allowed without approval of Engineer.
- D. Black steel piping may be welded with chill rings in lieu of that specified.
- E. All welds cleaned and given one coat of black, rust-inhibiting paint.
- F. Mitered turns will not be allowed. Turns shall be made with welded type fittings.
- G. Branch take-offs with manufactured formed nipples will be permitted, if not restricted by code, and where nipple size is at least two pipe sizes smaller than the main size. Formed nipples shall be Bonney Forge "Weldolets", "Threadolets", "Sockolets".
- H. Shop welded pipe assemblies shall have all welds plainly stamped by the welding operator for inspection by the Engineer before installation.

3.4 PROTECTION AGAINST FREEZING:

- A. At any time that any of the piping is full of water for testing purposes or otherwise prior to actual heated operation, the system shall be protected against freezing by the introduction of an acceptable anti-freeze which will be flushed out before acceptance. Provision for introducing anti-freeze shall be made by means of valved connections to the system in an acceptable manner.

3.5 INSTALLATION OF PIPE HANGERS AND SUPPORTS:

- A. Arrange pipe hangers and supports to permit proper pitch of piping, free to move with pipe expansion, installed at proper intervals to totally prevent sagging and attached to building construction through approved means. Hangers shall be located near or at changes in piping direction and concentrated loads. Valves, strainers, in line pumps and other heavy equipment shall be supported independent of the pipes. After systems have been installed and filled adjust hangers and supports to evenly distribute weight, and maintain proper pitch. Refer to drawings for pipe hanger and support details.
- B. Vertical Piping: When support locations are not indicated on the drawings, support piping at every floor level (minimum).
- C. Horizontal Piping: Spacing of Hangers and Supports
1. A hanger or support shall be installed not over one foot from each change in direction of piping.
 2. Hangers and supports for straight runs of piping shall not exceed the spacing listed below.

Type of Pipe	Size	Maximum Spacing
Steel	Up thru 1-1/4"	7'-6"
Steel	1-1/2" thru 3-1/2"	10'-0"
Steel	4" thru 5"	15'-0"
Steel	6" and Up	20'-0"
DWV Copper	1-1/4" thru 1-1/2"	5'-0"
DWV Copper	2" thru 2-1/2"	7'-6"
DWV Copper	3" thru 4"	10'-0"
Type L or M Copper	Up thru 1"	5'-0"
Type L or M Copper	1-1/4" thru 1-1/2"	7'-6"
Type L or M Copper	2" and Up	10'-0"
Plastic	All	As recommended by Mfr.

3. In addition to the above maximum spacing, additional hangers shall be used at, heavy valves, multiple soil pipe fittings, etc., as necessary to prevent sagging and strain on equipment and fittings.
 4. Piping shall be supported independently from pumps and other in-line equipment so that equipment can be removed without the need for pipes to have temporary support.
 5. Victaulic pipe systems shall be supported as recommended by the system manufacturer.
 6. PEX-a piping to be provided with manufacturer's PEX-a pipe support. Installed as recommended by the system manufacturer.
- D. For cold piping, install hangers and supports to maintain an effective continuous thermal and vapor barrier between cold piping and hangers and supports.

3.6 INSTALLATION OF UNIONS

- A. Unions to be installed to facilitate the removal of any piece of equipment without having to cut any pipe.
- B. Piping shall be offset and provided with unions, flanges or Victaulic couplings where connected to equipment containing coils or tube bundles. Pipes to be connected in such a manner as to permit the removal of heads, coils, etc., with a minimum amount of disturbance to the piping system.

C. Use insulating union or flanges for joining dissimilar metals.

3.7 INSTALLATION OF PIPE SLEEVES:

- A. Install pipe sleeves where piping passes through building construction including all walls, floors and ceilings.
- B. For new wall construction, promptly and accurately locate and securely set sleeves in forms before concrete is poured. For masonry construction, set the sleeves over the piping for Masonry Contractor to build around.

3.8 INSTALLATION OF STRAINERS:

- A. Provide Y-strainers in water piping preceding control valves, traps, pressure relief valves, pressure regulating valves and elsewhere as shown on drawings.
- B. Install strainer elements prior to flushing piping. Remove, clean and reinstall during flushing.
- C. Strainers shall be installed so that there is adequate clearance for the removal and cleaning of the screen.
- D. Provide blowdown pipe and gate valve on cleanout. Run pipe down to floor or floor drain.
- E. Provide valved drain and 3/4" threaded hose connection off the cleanouts on strainer bottom.
- F. Every strainer shall be fitted with a blowdown pipe and blowdown valve.
- G. Blowdown valves shall be quarter-turn, full port ball valves for hydronic systems and gate valves for steam and condensate systems. Valves shall meet the requirements of SECTION 220523.
- H. Provide a hose thread connection in an accessible location downstream of each strainer blowdown.

3.9 EQUIPMENT MOUNTING

A. Floor Mounting

- 1. Concrete bases 4" high with chamfered edges shall be provided under all floor-mounted equipment such as pumps, water heaters, boilers, air handling units, chillers, compressors, condensers and other equipment where bases are called out or indicated on the drawings.
- 2. Floor-mounted equipment shall be secured to the concrete bases with steel anchor bolts preset in the concrete base. Anchor bolts and anchoring shall be capable of resisting horizontal and vertical earthquake forces as required in the International Building Code. Where spring-type vibration mounts are required, they shall be secured to the concrete bases and in addition, the equipment restrained whereby the equipment is free to vibrate but cannot move from the base.

B. Wall Mounting

- 1. Wall-mounted equipment, such as plumbing fixtures and heating/cooling units shall be securely fastened to the wall using appropriate fasteners such as toggle bolts, expansion bolts, etc. Provide backing as required.

C. Roof Mounting

- 1. This Contractor is responsible for providing curbs and mountings for roof-mounted equipment such as fans, air handling units, cooling towers and condensers. Curbs shall be in accord with the details on the drawings and shall be prepared and flashed in conjunction with the roofing work.

3.10 FIRE PROTECTION PIPING HANGERS AND SUPPORTS

- A. Support fire-protection system piping independent of other piping.

3.11 FLUSHING AND CLEANING OF PIPING:

- A. Flush and clean the following piping systems:

- 1. Cold Water (flush only)

2. Hot Water (flush only)
- B.** Develop plan for flushing and cleaning piping. Submit plan for approval prior to completion of piping. Provide all temporary and permanent piping, equipment, materials necessary to complete flushing and cleaning.
- C.** Prior to flushing, temporarily remove, isolate or bypass dirt sensitive equipment and devices, including the following:
 1. Automatic flow control valves
 2. Heating and cooling coils
 3. Boilers
 4. Chillers
 5. Heat exchangers
 6. Flow measuring devices
 7. Reinstall after flushing is complete.
- D.** Prior to flushing, install fine mesh construction strainers at inlet to all equipment with connections 2-1/2" and larger. Install fine mesh construction element in permanent strainers. During flushing and cleaning, remove and clean strainers periodically. At completion of final flush, clean permanent strainers, remove construction strainers.
- E.** Flushing for new piping: Flush all piping with cold water (or fire protection system where approved by owner) for a minimum of one hour, until water runs clear. Water supply shall be equivalent to piping to be flushed. Use (2) 2-1/2" fire hose connections for piping 3" and larger. Drain all low points.

3.12 PIPING SYSTEMS PRESSURE TESTING

A. General

1. Perform initial tests and correct deficiencies prior to requesting acceptance test.
2. Perform acceptance pressure tests in the presence of the Owner and authorities having jurisdiction. Acceptance tests must be satisfactorily completed before piping surfaces are concealed.
3. Pneumatic tests shall be conducted using dry, oil free compressed air, carbon dioxide or nitrogen. Evacuate personnel not directly involved in testing prior to performing pneumatic testing. Perform testing in two stages, initial and acceptance. Conduct initial testing at 5 PSI or less. Swab joints with a commercial leak detector. Repair deficiencies prior to testing at higher pressures. Under no circumstances shall plastic piping of any type be pneumatically tested, including pre-acceptance tests.
4. Components shall be removed or isolated during testing if damage may occur due to test pressure and/or test media.

END OF SECTION 221113

SECTION 221116 – PEX PIPING SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Domestic potable hot and cold water plumbing system, where shown on the Drawings and Schedules, shall be crosslinked polyethylene pipe, and shall include the following:

1. Crosslinked polyethylene (PEXa) piping.
2. Distribution manifold(s) with balancing and flow control valves where required.
3. Cold-expansion fittings.
4. Pipe fasteners as approved by the manufacturer of the PEXa piping.
5. Supervision and field engineering required for the complete and proper function of the system.

1.2 REFERENCES

A. Publications listed here are part of this specification to the extent they are referenced. Where no specific edition of the standard or publication is identified, the current edition shall apply.

1. ASTM - American Society for Testing and Materials
2. ASTM D2765 – Standard Test Method for Determination of Gel Content and Swell Ratio of Crosslinked Ethylene Plastics
3. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials
4. ASTM E119 – Standard Test Methods for Fire Tests of Building Construction and Materials
5. ASTM F876 – Standard Specification for Crosslinked Polyethylene (PEX) Tubing
6. ASTM F877 – Standard Specification for Crosslinked Polyethylene (PEX) Plastic Hot- and Cold-Water Distribution Systems
7. ASTM F2023 – Standard Test Method for Evaluating the Oxidative Resistance of Crosslinked Polyethylene (PEX) Tubing and Systems to Hot Chlorinated Water
8. ASTM F2080 – Standard Specification for Cold-Expansion Fittings with Metal Compression-Sleeves for Crosslinked Polyethylene (PEX) Pipe
9. ASTM F1807 – Standard Specification for Metal Insert Fittings Utilizing a Copper Crimp Ring for SDR9 Crosslinked Polyethylene (PEX) Tubing and SDR9 Polyethylene of Raised Temperature (PE-RT) Tubing
10. ASTM F2159 – Standard Specification for Plastic Insert Fittings Utilizing a Copper Crimp Ring for SDR9 Crosslinked Polyethylene (PEX) Tubing and SDR9 Polyethylene of Raised Temperature (PE-RT) Tubing
11. ASTM F2657 – Standard Test Method for Outdoor Weathering Exposure of Crosslinked Polyethylene (PEX) Tubing
12. ASTM F1960 – Standard Specification for Cold Expansion Fittings with PEX Reinforcing Rings for Use with Crosslinked Polyethylene (PEX) Tubing
13. ASSE 1061 – Performance Requirements for Push-Fit Fittings
14. AWWA – American Water Works Association
15. AWWA C904-06 - Crosslinked Polyethylene (PEX) Pressure Pipe, 1/2 In.(12 mm) Through 3 In. (76 mm), for Water Service
16. CSA Canadian Standards Associations
17. CSA B137.5 – Crosslinked Polyethylene (PEX) Tubing Systems for Pressure Applications
18. IAPMO – International Association of Plumbing and Mechanical Officials
19. ICC – International Code Council
20. ISO – International Organization for Standardization
21. ISO 9001 – Quality Management Systems – Requirements
22. NSF International
23. NSF/ANSI 14 – Plastic Piping System Components and Related Materials

24. NSF/ANSI 61 – Drinking Water System Components – Health Effects
25. Plastic Pipe Institute
26. PPI TR-3– Policies and Procedures for Developing Hydrostatic Design Basis (HDB), Pressure Design Basis (PDB), Strength Design Basis (SDB), and Minimum Required Strength (MRS) Ratings for Thermoplastic Piping Materials or Pipe
27. Underwriters' Laboratories
28. ANSI/UL 263 – Standard Fire Tests of Building Construction and Materials
29. Underwriters' Laboratories of Canada
30. CAN/ULC S101 – PEX Pipe through Fire Rated Assemblies
31. CAN/ULC S102.2 – Surface Burning Characteristics of Flooring, Floor Covering and Miscellaneous Materials

1.3 DEFINITIONS

- A. Crosslinked polyethylene, commonly abbreviated PEX, is made from high density polyethylene (HDPE). Crosslinking is accomplished during manufacturing. Crosslinking enhances the physical & mechanical properties of the polymer. The high-temperature properties are improved. Chemical resistance is enhanced by resisting dissolution. Low temperature properties are also improved; its impact and tensile strength, scratch resistance, and resistance to brittle fracture are enhanced. The required degree of crosslinking, according to ASTM Standard F876, is between 70-89%. This specification requires PEX to be designated as PEXa and be manufactured by the high-pressure peroxide method.

1.4 SYSTEM DESCRIPTION

A. Design Requirements

1. Standard grade hydrostatic pressure ratings from Plastics Pipe Institute in accordance with TR-3. The following three standard-grade hydrostatic ratings are required:
 - a. 200°F (93°C) at 80 psi (551 kPa)
 - b. 180°F (82°C) at 100 psi (689 kPa)
 - c. 73.4°F (23°C) at 160 psi (1102 kPa)
2. Listing of Flame Spread Index and Smoke Developed Index to ASTM E 84 (in U.S.) and ULC S102.2. (in Canada). It may be necessary to encase with 1/2 inch fiberglass insulation or 1/2 inch Armaflex insulation as required by the manufacturer's listing.

- B. Performance Requirements: To provide a domestic potable hot and cold water plumbing system, which is manufactured, fabricated and installed to comply with regulatory agencies and to maintain performance criteria stated by the PEX pipe manufacturer without defects, damage or failure.

C. Compliant to the following standards:

1. NSF/ANSI Standard 14
2. NSF/ANSI Standard 61
3. ASTM F876
4. ASTM F877 (Potable systems only)
5. ASTM E119
6. ANSI/UL 263 through certification listings with Underwriters Laboratories, Inc. (UL).
 - a. UL Design No. L588— 1 hour wood frame floor/ceiling assemblies
 - b. UL Design No. K917 — 2 hour concrete floor/ceiling assemblies
 - c. UL Design No. U383 — 1 hour wood stud/gypsum wallboard wall assemblies
 - d. UL Design No. V461 — 1 hour steel stud/gypsum wallboard wall assemblies
7. CSA B137.5

1.5 SUBMITTALS

- A. Comply with Section 220000. Approval and/or acceptance of all submittals are required prior to procurement.
- B. Product Data: Submit manufacturer's Technical Manual, submittal forms, catalog cuts, brochures, specifications, and installation instructions. Submit data in sufficient detail to indicate compliance with the contract documents.

1. Submit manufacturer's instructions for installation.
2. Submit data for equipment, fittings, fasteners and associated items necessary for the installation of the piping and manifolds.

C. Certification:

1. Submit independent certification results for the piping systems from an accredited independent testing laboratory.
2. Fittings shall be third-party as approved by the manufacturer's PEX piping system with applicable plumbing and mechanical code certifications.
3. Fittings encased behind walls or ceilings shall be certified to ASTM F1960.

D. Maintenance Instructions: Submit instructions for any maintenance required or recommended by manufacturer.

1.6 QUALITY ASSURANCE

A. Pipe shall be manufactured in a facility whose quality management system is ISO 9001 certified.

B. All piping system materials of a given type shall be manufactured by a single source, and supplied by a single supplier.

C. Crosslinked polyethylene (PEXa) pipe shall conform and be certified to ASTM F876 and/or F877 and CSA B137.5. Fittings shall conform and be third-party certified to ASTM F1960 fitting standard listed in Section 1.02 B.

D. Fittings manufactured and third-party certified to ASTM F2159 or ASTM F1807 will not be permitted.

E. Installer Qualifications: Installer shall have demonstrated experience on projects of similar size and complexity with documentation proving successful completion of plumbing system installation and/or training by the PEX tubing manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store piping and equipment in a safe place, dry, enclosed, under cover, in a well-ventilated area.

1. Pipe shall be kept in original shipping boxes until required for installation.
2. Do not expose pipe to ultraviolet light beyond exposure limits recommended by manufacturer.
3. Protect piping and manifolds from entry of contaminating materials. Install suitable plugs in open pipe ends until installation.
4. Where possible, connect pipes to assembled manifolds to eliminate possibility of contaminants and cross-connections.
5. Piping shall not be dragged across the ground or other surfaces, and shall be stored on a flat surface with no sharp edges.

B. Protect materials from damage by other trades.

C. Pipe shall be protected from oil, grease, paint, direct sunlight and other elements as recommended by manufacturer.

1.8 WARRANTY

A. Provide manufacturer's standard written warranty.

1. To repairing or replacing the defective product in question or providing a refund of the defective product's purchase price.
2. The radiant heating pipe manufacturer shall warrant the cross-linked polyethylene piping to be free from defects in material and workmanship for a period of twenty-five (25) years.
3. Cold-expansion fittings shall be warranted to be free from defects in material and workmanship for a period of twenty-five (25) years.

4. All manifolds, distribution headers, thermostats and actuators shall be warranted to be free from defects in material and workmanship for a period of one (1) year starting at completion of successful pressurized water tests immediately following system installation.

B. Provide installer's guarantee as appropriate.

PART 2 - PRODUCTS

2.1 COMPONENTS

A. Piping

1. All pipe shall be high-density crosslinked polyethylene manufactured using the high-pressure peroxide method of crosslinking (PEXa). Pipe shall conform to ASTM F876, ASTM F877 CSA B137.5, NSF/ANSI 14 and NSF/ANSI 61.
2. Supplier shall provide pipe in sizes 1/2, 3/4, 1, 1-1/4, 1-1/2, 2, 2-1/2, and 3 in.
3. Pipe shall be rated for continuous operation of 100 psi gauge pressure at 180°F temperature (690 kPa @ 82°C), and 80 psi gauge pressure at 200°F temperature (550 kPa @ 93°C).
4. Pipe shall be certified by PPI to standard TR-3, with applicable plumbing and mechanical code certifications.
5. Pipe to be tested for resistance to hot chlorinated water in accordance with ASTM F2023. Pipe to have a minimum extrapolated time-to-failure of 50 years, calculated in accordance with section 13.3 of F2023 and listed as "3306" per the ASTM F876 standard.
6. When required, PEX pipe to have a co-extruded red, white or blue UV Shield made from UV-resistant polyethylene providing a minimum UV resistance of 6 months when tested according to ASTM F2657.
7. Pipe to be manufactured in an ISO 9001 certified production facility.
8. Bend Radius:
 - a. The minimum bend radius for cold bending of the pipe shall be not less than five (5) times the outside diameter.
 - b. Bends with a radius less than this shall require the use of a bending template as supplied by the pipe manufacturer, and/or hot air.
9. Pipe to have a Flame Spread Index and a Smoke Developed Index listing to ASTM E84 (in U.S.) or CAN/ULC S102.2 (in Canada).
10. Pipe shall be supported by manufacturers metal PEX-a pipe support to approach hanger spacing similar to copper piping.

B. Fittings

1. All Fittings used with crosslinked polyethylene (PEX) water distribution pipe intended for plumbing applications shall be certified to the respective fitting standard listed in Section 1.2 B.
2. All Fittings shall be third-party certified to applicable standards ASTM F877, NSF/ANSI 14, NSF/ANSI 61 and CSA B137.5 and approved by the manufacturer's PEX piping system, with applicable plumbing and mechanical code certifications.
3. Where fittings are encased in concrete or buried underground, fittings shall be wrapped as per manufacturer's recommendation to protect the material.

C. Manifolds

1. Material: Distribution manifolds shall be manufactured of copper and be supplied by the piping manufacturer as a proven cataloged part of the manufacturer's system.
2. Copper manifolds
 - a. Copper manifolds shall be manufactured from Type L copper.

- b. Copper and/or brass outlets shall be high-temperature brazed (lead-free) into headers.

2.2 MARKINGS

- A. Pipe shall carry the following markings every three (3) feet (0.9 meters): Manufacturer's name or trademark, nominal size, PEXa 3306 (material designation) SDR9 (standard dimension ratio), ASTM F876/ F877 / F1960, CSA B137.5, NSF-pw, U.P. Code, 160 psi @ 73.4°F / 100 psi @ 180°F / 80 psi @ 200°F, POTABLE TUBING, manufacturing date and footage mark.

PART 3 - EXECUTION

3.1 ACCEPTABLE INSTALLERS

- A. As a minimum, installation shall be performed by qualified laborers trained by the manufacturer in the procedures of PEX systems appropriately licensed for the jurisdiction where the installation will take place.
- B. Installers must comply with manufacturers technical guidelines, including but not limited to technical manuals, installation guides, technical bulletins and product submittals.

3.2 PREPARATION

- A. Coordinate with related trades and manufacturer's recommendations for installation locations and methods prior to commencement of work.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's published installation manual and/or technical guidelines and final drawings. Technical guidelines are the most current and applicable versions of all the technical literature, including but not limited to technical manuals, installation guides, technical bulletins, training presentations and submittals
- B. Manifolds shall be mounted level.
- C. Route piping in an orderly manner, according to layout and spacing shown in final drawings. All installation notes shown on the drawings shall be followed.
- D. At connections and fittings, use a plastic pipe cutter to ensure square (90°) and clean cuts, and join pipes immediately or cap ends of pipe to seal from contaminants.
- E. Pipe shall be dispensed using a suitable uncoiling device. Remove twists prior to securing pipe. Pipe shall lie flat on an even plane.
- F. Piping that passes through expansion joints or walls shall be covered in protective polyethylene convoluted sleeving (flexible conduit) extending 15 in (38 cm) on each side of the joint. Sleeving shall be secured on pipe to prevent movement during installation.
- G. Where piping enters or exits a wall a protective conduit shall be placed around the pipe, with the conduit extending a minimum of 6 in (15 cm) into the wall and exiting by a minimum of 6 in (15 cm). For penetrations at manifolds, use rigid PVC bend guides secured in place to prevent movement.
- H. Pipe Joint Construction: PEX-a Connections: Install per manufacturer's recommendations. Use manufacturer-recommended cold-expansion tool for ASTM F 1960 connections.

3.4 FIELD QUALITY CONTROL

- A. Filling, Testing & Balancing: Tests of domestic plumbing systems shall comply with authorities having jurisdiction, and, where required, shall be witnessed by the building official.
- B. Pressure gauges used in testing and balancing shall show pressure increments of 1 psig and shall be located at or near the lowest points in the distribution system.
- C. Air Test

1. Charge the completed, yet unconcealed pipes with air at a minimum of 40 psig.
2. Do not exceed 150 psig.
3. Use soap solution to check for leakage at manifold connections.

D. Water Test

1. Purge air from pipes.
2. Charge the completed, yet unconcealed pipes with water.
3. Take necessary precautions to prevent water from freezing.
4. Check the system for leakage, especially at all pipe joints.

E. Perform a preliminary pressure test pressurizing the system to the greater of 1.5 times the maximum operating pressure or 100 psig for 30 minutes.

1. As the piping expands, restore pressure, first at 10 minutes into the test and again at 20 minutes.
2. At the end of the 30-minute preliminary test, pressure shall not fall by more than 8 psig from the maximum, and there shall be no leakage.

F. After successfully performing the preliminary pressure test, perform the main pressure test immediately.

1. The test pressure shall be restored and continued as the main test for 2 hours.
2. The main test pressure shall not fall more than 3 psig after 2 hours.
3. No leakage shall be detected.

G. Complete inspection and furnish test reports supplied by the manufacturer of the system.

H. Do not expose PEX piping to direct sunlight for more than 30 days. If construction delays are encountered, provide cover to portions of piping exposed to direct sunlight.

3.5 CLEANING

A. Clean exposed surfaces upon completion of installation using clean, damp cloth. No cleaning agents are allowed.

B. Comply with manufacturer's recommendations.

3.6 PROTECTION

A. Protect installation throughout construction process until date of final completion.

B. Replace components that cannot be repaired.

C. The contractor shall instruct the Owner in the correct procedures to winterize the system and drain those portions necessary to prevent freezing.

END OF SECTION 221116

SECTION 221119 – PIPING SPECIALTIES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, Standard General and Supplementary General Conditions, Division 1 Specification Sections, and other applicable Specification Sections including the Related Sections listed below, apply to this Section.

1.2 SCOPE OF WORK:

- A. Provide piping, fittings, and specialties up to point 5 feet beyond the building for the following systems:
 - 1. Domestic Cold Water System
 - 2. Domestic Hot Water System

1.3 SUBMITTAL DATA

- A. See SECTION 220000 for general submittal requirements.
- B. Provide submittal data for any materials or equipment specified in this Section as listed on the Submittal Schedule (see SECTION 220000) and any special or additional data as requested by the Engineer.
- C. Submit complete manufacturer's literature, O&M Manuals and installation instructions for water heaters, pumps, heat trace cable and other equipment so noted. Shop drawings on pipe, fittings, flues, etc., are not required.

1.4 BACKFLOW PREVENTION

- A. Provide anti-siphon and backflow prevention devices on any equipment capable of backflow into the domestic water system. This includes faucets with hose threads and equipment with any supply pipe opening below the water line of the fixture. If not specified or noted on the drawings, such devices to be as approved by the State Board of Health.

1.5 HOT WATER HEAT MAINTENANCE SYSTEM

- A. Where hot water recirculation systems are employed, each system or part of a system which forms a separate circulating circuit shall be fitted with an isolation valve, check valve and a balance cock.
- B. Flow balance of the recirculation system shall be conducted as herein after noted.

PART 2 PRODUCTS

2.1 GENERAL

- A. All wetted seals shall be made from materials that are immune from chloramine degradation. EPDM seals shall be peroxide cured.

2.2 PIPING

- A. Interior Cold and Hot Water Pipe
 - 1. Type L hard temper copper pipe with solder joint fittings.
 - 2. Solder shall be 95/5 tin/antimony composition. Self-fluxing solder shall not be used.
 - 3. Type K soft temper copper pipe with flare pattern fittings.

2.3 CIRCULATOR PUMPS

- A. Size and type as noted on the drawings.

- B. Equivalent products of Armstrong, Bell & Gossett, Grundfs and Taco are acceptable.
- C. When so noted, the circulator shall include and be controlled from a 7-day, programmable time clock.

2.4 MIXING VALVE

- A. Provide Symmons thermostatic controller with swivel action check stops, removable cartridge with strainer, stainless steel piston and liquid fill thermal motor with bellows mounted out of water. Volume control shut off valve, bimetal dial thermometer (3" face, range 20°-240° F), brass pipe, fittings and unions. Standard valve and piping finish is rough bronze, brass or copper.
- B. Options: Provide polished chrome finish and wall mounting bracket.

2.5 MIXING VALVE

- A. Thermostatic mixing valve body construction shall be brass and bronze with brass and stainless steel flow control components. Standard finish rough bronze, inlets and outlet IPS unless indicated otherwise.
- B. Options: Provide with separate check stops.

2.6 PIPING SPECIALTIES

- A. Water Hammer Arresters: Certified per PDI Standard WH-201. Bellows type, with stainless steel casing and bellows, pressure rated for 250 psi. Piston type, precharged to 60 psig, suitable for installation in any position.
Manufacturers: (Bellows) Zurn Shoktrol or by J.R. Smith, Wade; (Piston) Sioux Chief
- B. Wall Faucet - Freezeless: Bronze body, extended stem to suit wall construction, renewable composition disc, wheel handle, 3/4 inch MPT inlet, hose outlet with integral vacuum breaker.
Manufacturers: Woodford, J. R. Smith, Chicago, Zurn
- C. Wall Faucet - for indoor use: Bronze body, renewable composition disc, wheel handle, 3/4 inch FPT inlet, hose outlet with integral vacuum breaker.
Manufacturers: Woodford, J. R. Smith, Chicago, Zurn
- D. Recessed Nonfreeze Wall Hydrants: Brass box with chrome-plated face, hinged locking cover, brass body and casing, T-Key handle, vacuum breaker, 3/4-inch FPT inlet, hose outlet, inlet stem to suit wall construction.
Manufacturers: Woodford, J. R. Smith, Chicago, Zurn
- E. Exposed Nonfreeze Wall Hydrants: Chrome plated brass body, T-Key handle, vacuum breaker, 3/4-inch inlet, and hose outlet, inlet stem to suit wall construction.
Manufacturers: Woodford, J. R. Smith, Chicago, Zurn
- F. Vacuum Breakers: Hose connection vacuum breakers shall conform to ASSE Standard 1011, with finish to match hose connection.
Manufacturers: Chicago, Watts, Kewanee
- G. Backflow Preventer - Reduced Pressure Zone: Includes dual check valves, reduced pressure relief valve and air vent, shutoff valves on inlet and outlet, strainer on inlet, test ports with test cocks, manufacturer's standard materials. ASSE Standard 1013 certified.
Manufacturer: Watts 909 Series, Conbraco, Febco
- H. Backflow Preventer - Double Check Valve Assembly: Includes double check valves, shutoff valves on inlet and outlet, strainer on inlet, test ports with test cocks, manufacturer's standard materials. ASSE Standard 1015 certified.
Manufacturer: Watts 709 Series, Conbraco, Febco.
- I. Backflow Preventer - Dual Check Valve: Includes two removable check valve assemblies, manufacturer's standard materials. ASSE Standard 1024 certified.
Manufacturer: Watts 7 Series, Conbraco, Febco.

- J. Atmospheric Vacuum Breaker - Single float and disc with large atmospheric port. Angle pattern brass body, with chrome plated finish, ½" inlet and outlet unless otherwise noted. ASSE Standard 1001 certified.
Manufacturer: Watts 288A Series, Chicago Water Saver Model L-102.
- K. Pressure Type Vacuum Breaker - Spring loaded single float and disc with independent first check valve, manufacturer's standard materials, with test cocks and ball type isolation valves. ASSE Standard 1020 certified. Manufacturer: Watts 800 Series, Conbraco, Febco.
- L. Pressure-Regulating Valves: Single-seated, direct-operated type, having bronze body with integral strainer and complying with requirements of ASSE Standard 1003. Select proper size for maximum flow rate and inlet and outlet pressures indicated.
Manufacturer: B&G Model 350, Conbraco, Watts.
- M. Combined Pressure-Temperature Relief Valves: Bronze body, test lever, thermostat, ANSI Z21.22. Factory set at 210 degrees F, and 150 psig. Size valves in accordance with ASME Boiler and Pressure Vessel Codes. Manufacturers: Watt series 40, 140, 240, 340, Spirax-Sarco, Leslie

2.7 WATER METER

- A. General: Water meters are supplied and installed by the Local Utility, paid for by the owner. Coordinate piping rough in and installation with the Local Utility provider.

2.8 ESCUTCHEONS

- A. Provide chrome-plated, concealed hinge, split-ring escutcheons on all exposed pipe passing through walls, floors and ceilings. Escutcheons shall fit snugly to pipes or insulation and shall be held in place by internal tension springs.
- B. Escutcheons furnished with plumbing fixture trim when deep enough to cover sleeve or hole, they may be used in lieu of A. above.

2.9 SLEEVES

- A. Sleeves in masonry walls shall be PVC pipe, steel pipe or cast iron pipe.
- B. Provide steel pipe sleeves for pipes passing through exterior walls below grade. Make space between sleeve and pipe watertight with polyurethane expanding foam adhesive such as 3M "DP900" expanding foam of equal.

2.10 FLASHINGS

- A. Flashing shields used in conjunction with built-up roofs shall be made from sheet lead not lighter than 4 lb. per square foot. Flashings shall be 30 inches square for roof drains and extend 8 inches out from pipes passing through roofing.

PART 3 EXECUTION

3.1 INSTALLATION OF PIPING SPECIALTIES

- A. Install backflow preventers and vacuum breakers where shown on drawings, in compliance with the plumbing code and authority having jurisdiction. Install air gap fitting and pipe relief (where applicable) to sanitary waste. Test backflow prevention for proper operation. Tests shall be by Certified Tester. Provide Owner with one (1) copy of each backflow prevention test report.
- B. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping to all fast closing solenoid and flush valves.
- C. Slope all piping for proper air relief and drainage.
- D. Make adequate provisions for pipe expansion. Anchor, block and brace pipe to prevent movement from water surges and hammer.

3.2 FLUSHING, DISINFECTING AND TESTING

A. Flush, disinfect and test domestic water piping as follows:

1. Flush all domestic water piping per Related Section 221113.
2. Purge and disinfect domestic water piping per local requirements.
3. Submit water samples in sterile bottles to the local authority and to the State Department of Health. Repeat the procedure if the biological examination shows evidence of contamination.
4. Prepare reports for all purging and disinfecting activities. Furnish owner final copy of test results for acceptance.
5. Test piping system before connecting to existing systems, before applying insulation and before concealing.
6. Items not designed to take test pressures must be isolated from the line during testing.
7. Test the system by applying a hydrostatic pressure of 100 psi held for 1/2 hour without any drop in pressure or other indication of leakage.
8. Leaks shall be repaired and the test repeated until all systems prove tight.

3.3 HOT WATER RECIRCULATION SYSTEM BALANCE

A. Each hot water recirculation line shall be balanced. Method of balance shall be to throttle the balance cock to allow only the minimum quantity of water necessary to maintain hot water distribution line temperature at point of connection to the recirculation line. Balance to be conducted at a time when no fixtures are flowing hot water.

3.4 CIRCULATOR PUMPS

- A. Where the pipe does not provide adequate support for in-line pumps, the pipe shall be braced or the pump supported independently with steel angle iron bracket bolted to the pump flange only. Do not support with motor mount.
- B. Lubricate in accord with the manufacturer's directions on start-up.

3.5 REDUCED PRESSURE TYPE BACKFLOW PREVENTER

A. Install air gap fitting on the drain of the back flow preventer. Pipe air gap to nearest floor drain or waste receptor.

3.6 ESCUTCHEONS

A. Fit snugly to the pipe or insulation jacket and tight against the wall, floor or ceiling surface.

3.7 SLEEVES

- A. All pipe penetrations through floors and walls, including exterior and foundation walls, shall be sleeved except as listed below.
- B. With the exception of 'wet' areas, pipes passing through concrete floors and above-grade interior concrete walls may be core-drilled or cast with an appropriate smooth plug in lieu of sleeving.
- C. Pipe openings in gypsum board walls may be framed, rather than sleeved, as long as the framing members are metallic and the opening dimensions do not interfere with proper installation of any required firestopping.
- D. All penetrations of mechanical room floors and other potentially 'wet' areas shall be sleeved. The sleeves in these areas shall be extended 1/2" above the floor surface to act as a dam to prevent the passage of spilled water.
- E. Holes for pipe penetrations which must be cut through existing concrete or masonry floors and walls shall be drilled with a masonry core drill. In no case shall chipping or hammering be used without prior approval of the Engineer.
- F. Pipe penetrations through all fire-rated floors, walls and ceilings or other fire-rated assemblies shall be sealed to maintain the fire rating. See SECTION 210000 or 220100 for sealant material.

- G. Each sleeve shall extend entirely through its respective wall or floor penetration and shall be cut flush with the surface on each side. See exception above for special floor penetrations in 'wet' areas.
- H. Each sleeve or hole shall be sized to provide 1/4" clearance (minimum) around the perimeter of the passing pipe or its insulation.
- I. Ream sleeves to remove sharp edges and burrs. Seal all sleeves to wall surfaces. All sleeves through masonry or concrete walls shall be grouted in place.
- J. Provide any special sleeves and sealants as detailed on the plans.

3.8 FLASHINGS

- A. Provide flashings for roof drains and pipes passing through built-up roofing. Flashings shall be set in a solid coat of bituminous cement, lapped and stripflashed into the roofing membrane as specified in SECTION: ROOFING.
- B. Coordinate installation of drains and pipes through metal or membrane roofs with roof installers.

END OF SECTION 221119

SECTION 221316 – SOIL, WASTE, VENT, AND DRAIN PIPING SYSTEMS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, Standard General and Supplementary General Conditions, Division 1 Specification Sections, and other applicable Specification Sections including the Related Sections listed below, apply to this Section.

1.2 SCOPE OF WORK

- A. Provide piping, fittings, and specialties up to point 5 feet beyond the building for the following systems:
 - 1. Sanitary Waste and Vent System
 - 2. Storm Waste System
- B. This section specifies materials and installation for the following specialties:
 - 1. Clean-outs
 - 2. Floor Drains
 - 3. Trench Drains
 - 4. Roof Drains
 - 5. Drainage Specialties (backwater valves, trap primers, neutralization tanks)

1.3 CODE COMPLIANCE

- A. The work shall be in accordance with the requirements of the State Plumbing Code and the local plumbing codes and regulations.
- B. Where more stringent requirements are specified herein, then the work shall comply with the specified requirements.

PART 2 PRODUCTS

2.1 PIPING

- A. Underground Piping
 - 1. Buried piping under building and 5 feet beyond building shall be Service Weight (SV) cast iron soil pipe conforming to ASTM Specification No. A74 and C564.
 - 2. See Section 221113 for additional information.
 - 3. At Contractor's option, PVC plastic Type DWV pipe and fittings may be used as permitted by the State Plumbing Code and local regulations.
 - 4. PVC plastic pipe will not be allowed in systems which are subject to water temperatures above 100° such as from kitchens, boiler and water heating blowdowns or industrial wastes containing organic solvents, strong detergents or other agents which may be harmful to the pipe. PVC piping and fittings shall be solid wall and conform to ASTM D 1784. Cellular core or Foam core PVC shall not be used.
- B. Aboveground Piping

1. Non-buried piping and piping above floor slab shall be one of the following:
 - a. Service weight (SV) cast iron soil pipe conforming to ASTM Specification No. A74 and C564. Neoprene couplings may be used where in compliance with State and local codes.
 - b. Galvanized steel pipe, Schedule 40, ASTM A-120, with cast iron threaded drainage pattern fittings.
 - c. Type DWV copper pipe and fittings with joints soldered with 50/50 solder.
2. At Contractor's option, PVC plastic Type DWV pipe and fittings may be used as permitted by the Montana State Plumbing Code and local regulations.
3. At Contractor's option, No-Hub mechanical joint piping may be used as permitted by the Montana State Plumbing Code and local regulations.
4. Type DWV copper or Type DWV plastic PVC (if permitted by Code) shall be used where space does not permit cast iron or steel pipe.
5. PVC plastic pipe will not be allowed in systems which are subject to water temperatures above 100° such as from kitchens, boiler and water heating blowdowns or industrial wastes containing organic solvents, strong detergents or other agents which may be harmful to the pipe.

C. Roof Drain Piping

1. Interior downspouts shall be one of the above listed pipe materials or Schedule 40 black steel may be used. Fittings may be threaded, welded or Victaulic pipe.

D. Plastic Pipe and Fittings

1. Polyvinyl chloride (PVC) Schedule 40 shall conform to ASTM C 2665.

2.2 CLEAN-OUTS

- A. Floor Clean-Out: Cast iron body, round, adjustable, scoriated, secured, nickel-bronze top, threaded and slotted bronze closure plug, outlet connection to suit application. For carpeted floors, provide nickel bronze carpet clamping frame and cover. Manufacturer: Sioux Chief
- B. Wall Clean-Out: Threaded bronze plug in cast iron tee or ferrule, with stainless steel cover.
- C. Exposed Clean-Out: Threaded plug, of material compatible with system piping.

2.3 FLOOR DRAINS

- A. Floor drain type designations and sizes are indicated on Drawings.
- B. Provide funnel type floor drain cover for floor drains used for cooling coil condensate drains, equipment drains and wherever shown on drawings. See details.

2.4 TRENCH DRAINS

- A. Trench drain type designations and sizes are indicated on Drawings and schedules.

2.5 ROOF DRAINS

- A. General roof drain requirements: Unless otherwise noted, provide secured round cast iron dome, cast iron body and flashing clamp/ gravel stop, sump receiver, underdeck clamp, bottom outlet same size as pipe served, with caulked, no-hub or neoprene gasket connection.

2.6 DRAINAGE SPECIALTIES

- A. Trap Primers: ASSE 1018, bronze body valve with automatic vacuum breaker, with 1/2 inch connections. Manufacturers: Precision Plumbing Products Model P-1

PART 3 EXECUTION

3.1 EXAMINATION AND PREPARATION

- A. Verify existing grades, inverts, utilities, obstacles, and topographical conditions prior to installations.
- B. Examine rough-in requirements for plumbing fixtures and other equipment having drain connections to verify actual locations of piping connections prior to installation.
- C. Examine walls, floors, roof, and plumbing chases for suitable conditions where piping and specialties are to be installed.

3.2 INSTALLATION OF PIPING

- A. Refer to Related Section 221113 for additional requirements.
- B. Install underground cast iron piping per Cast Iron Soil Pipe Institute Engineering Manual.
- C. Slope 1/4" per foot where possible and not less than 1/8" per foot.
- D. Changes in direction made with appropriate fittings. Long bends used where possible.
- E. Plumbing System Vents:
 - 1. All fixtures vented.
 - 2. Horizontal vents sloped up not less than 1/8" per foot.
 - 3. Extend vents to minimum 12" above roof.
 - 4. Increase vents to minimum of 3" diameter before going through roof.

3.3 INSTALLATION OF CLEANOUTS

- A. Provide cleanouts at each change in direction of piping greater than 45 degrees, where indicated on drawings and where required by code. Clean-outs shall be same size as pipe served through 4".
Above Ground Cleanouts: Install cleanouts at minimum intervals of 50' and at the base of each vertical soil or waste stack.
- B. Encase exterior cleanouts in concrete flush with grade.
- C. Cleanouts shall be aesthetically located with respect to tile patterns, masonry bond and alignment. Coordinate installation with masonry and concrete work.
- D. Prior to acceptance of the system, demonstrate that cleanout plugs are easily removable and can be easily rodded.
- E. When cleanouts are required in above grade floors, flash and clamp cleanouts in floors provided with membrane waterproofing as specified for floor drains.

3.4 INSTALLATION OF FLOOR DRAINS

- A. Install floor drains as indicated on drawings, at low points of surface areas to be drained.
- B. Provide trap for all floor drains, size per plumbing fixture schedule.
- C. Check drainage of surfaces by flooding with the hose.
- D. Provide vent for floor drain piping per code, minimum 1 1/2".

3.5 INSTALLATION OF ROOF DRAINS

- A. Install drain flashing collar or flange so that no leakage occurs between roof drain and adjoining roofing. Maintain integrity of waterproof membranes, where penetrated.

B. Check drainage of surfaces by flooding with hose.

3.6 TESTING

A. General

1. Piping to be tested before it is covered up or built-in. Leaks to be repaired and test repeated until system is approved.
2. Any damage occurring as result of testing, leaks, etc., shall be corrected at this Contractor's expense.

B. Sanitary Sewer System

1. Sanitary sewer drain and vent piping within building: Fill with water up at least 10 feet. Inspection to begin after 15 minutes, and there shall be no visible leaks.

C. Roof Drainage System

1. Test to consist of system being filled with water to roof. Inspection to begin after 15 minutes, and there shall be no visible leaks.

END OF SECTION 221316

SECTION 223500 – DOMESTIC WATER SYSTEM

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. This section governs the materials and installation of the domestic hot and cold water systems.

1.2 SUBMITTAL DATA

- A. See SECTION 220000 for general submittal requirements.
- B. Provide submittal data for any materials or equipment specified in this Section as listed on the Submittal Schedule (see SECTION 220000) and any special or additional data as requested by the Engineer.
- C. Submit complete manufacturer's literature, O&M Manuals and installation instructions for water heaters, pumps, and other equipment so noted.

1.3 BACKFLOW PREVENTION

- A. Provide anti-siphon and backflow prevention devices on any equipment capable of backflow into the domestic water system. This includes faucets with hose threads and equipment with any supply pipe opening below the water line of the fixture. If not specified or noted on the drawings, such devices to be as approved by the State Board of Health.

1.4 HOT WATER HEAT MAINTENANCE SYSTEM

- A. Where hot water recirculation systems are employed, each system or part of a system which forms a separate circulating circuit shall be fitted with an isolation valve, check valve and a balance cock.
- B. Flow balance of the recirculation system shall be conducted as herein after noted.
- C. Where electrical heat trace cable is used for temperature maintenance, the system will be identified by external markers.

PART 2 - PRODUCTS

2.1 PIPING

- A. Interior Cold and Hot Water Pipe

1. Type L hard temper copper pipe with solder joint fittings.
2. Solder shall be 95/5 tin/antimony composition. Self-fluxing solder shall not be used.
3. Type K soft temper copper pipe with flare pattern fittings.
4. Where permitted by Section 221119 – PEX conforming to ASTM F876 and ASTM F877 marked with ASTM F2080 and equipped with fittings certified to ASTM F2080.

2.2 WATER HEATER (GAS FIRED OR ELECTRIC, STORAGE TYPE)

- A. Heater is noted on the drawings.
- B. Equivalent products of Lochinvar, Ruud, Rheem or State are acceptable.
- C. Relief valve to be Watts No. 40XL or as approved.
- D. Double wall, tank within a tank design. Provide corrugated stainless steel inter tank and steel outer tank. Provide vents to atmosphere. Provide complete piping and wiring.
- E. Provide complete with vent piping to exterior with supports, roof flashing with storm collar, or sidewall termination.

F. Size combustion air and vent piping per manufacturers written instructions for total developed length.

PART 3 - EXECUTION

3.1 PIPE

A. See Section 221119.

3.2 WATER HEATER

A. Install in strict accordance with manufacturer's written instructions. Note especially, manufacturer's requirements of inlet gas pressures.

B. Isolate heater from piping system by installing dielectric unions in water pipe connections to the heater.

C. Install ball valves in the water connections to the heater.

D. Pipe relief valve to floor drain. Discharge pipe shall be the same size as the relief valve outlet.

E. Air and Vent Piping

1. Install completely in accordance with manufacturer's printed instructions and to meet all requirements of UL and NFPA. Observe UL required clearances to combustibles.
2. Extend above roof per manufacturers instructions for anticipated snow accumulation depth of project site, unless otherwise noted on drawings.
3. Adequately support.

F. Start-up and testing are to be performed by a factory authorized agent. Submit start-up and checkout reports to Engineer.

G. Seismic Anchors

1. Strap units to wall or support framing at 1/3 intervals.

END OF SECTION 223500

SECTION 224000 – PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, Standard General and Supplementary General Conditions, Division 1 Specification Sections, and other applicable Specification Sections including the Related Sections listed below, apply to this Section.
- B. Related Sections:
 - 1. Section 220000 Common Work Results for Plumbing
 - 2. Section 221113 Piping Materials and Methods
 - 3. Section 220523 Valves
 - 4. Division 26: Electrical.

1.2 SUMMARY

- A. Section Includes:
 - 1. Water Closets
 - 2. Water Closet Seats.
 - 3. W.C. and Urinal Wall Carriers.
 - 4. Urinals.
 - 5. W.C. and Urinal Flush Valves.
 - 6. Lavatories, Sinks, Service Sinks, and related Faucets and Trim.
 - 7. Lavatory Support Systems.
 - 8. Under-Sink Waste and Supply Pipe Guards.
 - 9. Thermostatic Mixing Valves (for hand-wash facilities).
 - 10. Shower Heads and Shower Control Valves.
 - 11. Electric Water Coolers.
 - 12. Emergency Fixtures, Tempering Valve.
 - 13. Garbage Disposer.
 - 14. Washing Machine Valve Box.
 - 15. Supply Tubes and Stops.
 - 16. Installation of fixtures including fixtures supplied by others for casework and fume hoods.

1.3 SUBMITTALS

- A. Product Data: For each type of fixture product.
 - 1. Construction details, material descriptions, rated capacities, operating characteristics dimensions of individual components and profiles, and finishes for fixtures.
 - 2. Water consumption data.
 - 3. Wiring diagrams for power, signal, and control wiring
 - 4. Proof of compliance to NSF/ANSI 61.
 - 5. Data sheets for each fixture shall be boldly marked with the same plumbing fixture identification as found on the plans and the plumbing fixture schedule (eg P-1, P-2, etc.)

1.4 QUALITY ASSURANCE

- A. Manufacturers and Products: The products and manufacturers specified in this Section establish the standard of quality for the work. Subject to compliance with all requirements, provide specified products from the manufacturers named in Part 2.

- B. The Contractor shall verify and resolve compatibility between separate components (e.g. that lavatory hole quantity and centering match that of the specified faucet, supports are compatible with respective urinals and water closets, etc.). **Model numbers, when provided, are partial model numbers for identifying style. Provide fixtures that meet all the specified requirements.**
- C. Reference Standards: Products in this section shall be built, tested, and installed in compliance with the following quality assurance standards; latest editions, unless noted otherwise.
 - 1. Uniform Plumbing Code
 - 2. NSF/ANSI-61-G Drinking Water System Components - Health Effects.
 - 3. ANSI Z358.1-2009 Standard for Emergency Eyewash and Shower Equipment

1.5 COMPLIANCE

- A. Cooperate in the installation of all fixtures with the General Contractor so that provisions can be made for required plumbing chase clearances, solid backing for mounting fixtures, chair carriers, shower units, drains, etc., and proper elevation for setting roof and floor drains.

1.6 WARRANTY

- A. Provide a complete parts and labor warranty for a minimum of one year from the date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Fixtures and their trim shall be complete in every respect, including such items as escutcheons, hanger plates, bolts, supplies, stops, traps, etc.
- B. See the "Plumbing Fixture Schedule" on the drawings, or notes on the drawings, for fixture types.
- C. Fixture trim for the entire job shall be supplied by the same manufacturer where possible in order to minimize spare parts inventories.
- D. Equivalent items of manufacturers listed may be used in lieu of items of the manufacturer specified if approved by the Engineer. Contractor must list all variations and exceptions between specified items and substitute manufacturer's items on the shop drawings. Substitute items must be equal or superior in quality to that specified.

2.2 WATER CLOSETS – FLUSH VALVE TYPE

- A. Vitreous china; color white unless noted otherwise. Elongated bowl, direct-fed siphon jet action. 1-1/2 inch top spud for external flush valve. Dimensions within ASME Standard A112.19.2 tolerances.
- B. Shall meet ASME A112.19.2 flush requirements at 1.1 gpf (liquids disposal) and 1.6 gpf (solids disposal) when equipped with a dual flush style valve.

2.3 WATER CLOSETS - STANDARD AND BARRIER FREE

- A. Wall mounted.
 - 1. ADA compliant when installed so top of seat is 17 in. to 19 in. from the finished floor.
 - 2. Acceptable Manufacturers:
 - a. American Standard
 - b. Kohler
 - c. Crane

- d. Sloan
 - e. Toto
- B. Floor mounted ADA compliant.
 - 1. Acceptable Manufacturers:
 - a. American Standard
 - b. Kohler
 - c. Crane
 - d. Sloan
 - e. Toto

2.4 WATER CLOSET FLUSH VALVES

- A. Manual, dual flush valve. Chrome plated, exposed, diaphragm type, water closet flushometer. ASTM classified as semi-red brass alloy. Chloramine resistant synthetic rubber diaphragms/seals. With 1-1/2 inch top spud, escutcheons, seat bumper, integral screwdriver stop and vacuum breaker. ADA compliant.
 - 1. Lifting Handle up initiates reduced flush 1.1 gpf eliminating liquid waste. Pushing handle down initiates full flush of 1.6 gpf eliminating all waste.
 - 2. Provide metal wall plate etched with flushing instructions.
 - 3. With flush valve manufacturer's chrome plated split ring wall pipe support accessory.
 - 4. Acceptable Manufacturers and Models:
 - a. Sloan "UpperCut".
 - b. Zurn "AquaVantage".

2.5 WATER CLOSET ACCESSORIES

- A. Standard Seat: 1 in. high: Solid white plastic, open front, extended back, self-sustaining stainless steel bolts and hinges, molded-in bumpers, without cover. Acceptable Manufacturers:
 - 1. Bemis.
 - 2. Church.
 - 3. Centoco
- B. High Style ADA Seat: where required to meet ADA requirements; 2 in. high, solid white plastic, open front, extended back, self-sustaining stainless steel bolts and hinges, molded-in bumpers, without cover. Acceptable Manufacturers:
 - 1. Bemis
 - 2. Church
 - 3. Centoco.
- C. Water Closet Wall Carrier: Fully compatible with water closet installation, adjustable, high extension (barrier free), cast iron frame with integral drain hub and vent, lugs for floor and wall attachment and threaded fixture studs. Acceptable Manufacturers and Models:
 - 1. Zurn.
 - 2. Josam.
 - 3. J.R. Smith.
 - 4. Wade Drain.

2.6 LAVATORIES - GENERAL

- A. Lavatories: Vitreous china. Color white unless noted otherwise. With faucet ledge, overflow, and strainer grid drain. ADA compliant.

2.7 LAVATORY SUPPORT SYSTEMS

- A. Wall Mounted Concealed Carrier Arms: cast iron and steel frame with tubular legs, lugs for floor and wall attachment, concealed arm supports, bearing plate and studs. Use at all walls except masonry type. Acceptable manufacturers:
 - 1. Josam.
 - 2. J.R. Smith.
 - 3. Wade.
 - 4. Zurn.

2.8 UNDERSINK WASTE AND SUPPLY PIPE GUARDS

- A. Provide ADA compliant undercounter protective covers on all supply and waste piping at barrier free lavatories. Covers shall be UV protected PVC, with reusable fastening system. Provide product type designed for the specific piping material over which it will be applied.
 - 1. Acceptable manufacturers and models:
 - a. Zurn.
 - b. IPS Corporation Truebro.

2.9 THERMOSTATIC MIXING VALVE - HAND WASHING FACILITIES

- A. Provide a thermostatic mixing valve at all public lavatories including at accessible plumbing fixtures. A maximum of 5 faucets within the same room may be served by 1 mixing valve.
- B. Provide mixing valves based on the following selection criteria:
 - 1. Mixing valve serving a single fixture: Valve pressure drop shall not exceed 5 psi at 1 gpm flow rate.
 - 2. Mixing valve serving 2-5 fixtures: Valve pressure drop shall not exceed 5 psi at 4.0 gpm flow rate.
- C. Mixing valve specification:
 - 1. Manually adjustable thermostatically controlled domestic water tempering valve.
 - 2. ASSE 1070 listed to control down to 0.5 GPM flow rate.
 - 3. All bronze or brass body, rough finish, chrome plated if exposed. Brass and stainless steel internal components.
 - 4. Chloramine resistant seals.
 - 5. Integral check valves and stainless steel strainers (screens) in hot and cold water inlet connections.
 - 6. Tamper resistant temperature adjustment handle.
 - 7. Union with male or female NPT connections, or compression fittings.
 - 8. Valves shall operate properly:
 - a. At supply pressures between 20 PSIG and 125 PSIG.
 - b. With up to 20 percent pressure differential between hot and cold water supplies.
 - 9. Outlet temperature shall be adjustable to within 10 deg. F of inlet hot water temperature.
 - 10. Hot inlet operating range: 120-180 deg. F.
 - 11. Lower temperature adjustment range: not more than 95 deg. F.
 - 12. Upper temperature adjustment range: not more than 140 deg. F.
- D. Acceptable manufacturers and models:
 - 1. Powers Hydroguard.
 - 2. Symmons Maxline.
 - 3. Wilkins Aqua-Gard.

2.10 SHOWER HEADS, SHOWER CONTROL VALVES, AND TRIM

- A. ADA Shower System: Including supply ell, wall flange, and slide bar. Hand held shower head with shut-off, swivel cradle with adjusting knob, (min.) 69 in. stainless steel hose, in line vacuum breaker. Shower head flow rate 2.5 gpm. All components shall be ADA compliant. Shower head shall be compatible with shower control valve range. Acceptable manufacturers:
 - 1. American Standard.
 - 2. Chicago Faucet.
 - 3. Speakman.
 - 4. Symmons.
 - 5. Kohler.
- B. Shower Head: Shower head, shank, and ball joint. 1.75 GPM flow rate. Spray adjusting side handle. Shower head shall be compatible with shower control valve range. Acceptable manufacturers and models:
 - 1. American Standard.
 - 2. Chicago Faucet.
 - 3. Speakman.
 - 4. Symmons.
 - 5. Kohler.
- C. Shower Control Valve (including tub/shower combination valves): Balanced pressure, thermostatic, or combination balanced pressure/thermostatic valve. ADA compliant.
 - 1. Vandal resistant chrome plated brass face plate, single handle, and tub spout (provide 4-port valve, diverter, and spout for bathtub applications).
 - 2. Brass body mixing valve with integral check stops, for concealed piping connections, capable of back-to-back installation.
 - 3. Adjustable limit stop factory set to 110 deg. F (120 deg. F max adjustment).
 - 4. Shall provide anti-scald protection and temperature regulation at inlet pressures as low as 20 psig (flowing), at flows from 1.75-2.5 gpm, at supply temperatures from 40 deg. F to 160 deg. F.
 - 5. Minimum static pressure rating: 125 psig.
- D. Acceptable manufacturers and models:
 - 1. American Standard.
 - 2. Chicago Faucet.
 - 3. Speakman.
 - 4. Symmons.
 - 5. Kohler.
 - 6. Powers.

2.11 ELECTRIC WATER COOLERS

- A. Electric Water Cooler: Vandal-resistant, wall mounted, refrigerated water cooler. ADA compliant.
 - 1. Stainless steel vented cabinet and integral basin, with removable access panel.
 - 2. Self-closing button operated. Polished chrome-plated bubbler head with flow adjustment. In-line removable strainer.
 - 3. Cooling System: Integral to water cooler. Insulated stainless steel evaporator tank. Copper tube/aluminum fin condenser. Non-CFC/HCFC refrigerant. Adjustable thermostat. 115V/1Ph/60Hz. UL listed.
 - 4. Delivers a minimum of 8 gph of water at 50 deg. F, cooled from 80 deg. F inlet water, at 90 deg. F, ambient.
 - 5. Certified to NSF/ANSI 61-G.

- B. Electric Water Cooler: Bi Level, vandal-resistant, wall mounted, refrigerated water cooler. ADA compliant.
1. Stainless steel vented cabinet and integral basin, with removable access panel.
 2. Self-closing button operated. Polished chrome-plated bubbler head with flow adjustment. In-line removable strainer.
 3. Cooling System: Integral to water cooler. Insulated stainless steel evaporator tank. Copper tube/aluminum fin condenser. Non-CFC/HCFC refrigerant. Adjustable, accessible thermostat. 115V/1Ph/60Hz. UL listed.
 4. Delivers a minimum of 8 gph of water at 50 deg. F, cooled from 80 deg. F inlet water, at 90 deg. F, ambient.
 5. Certified to NSF/ANSI 61-G.

2.12 EMERGENCY FIXTURES

- A. Emergency Eye/Face Wash: ANSI Z358.1-2009 compliant. Barrier Free.
1. See Plumbing Fixture schedule for equipment specification.
 2. Chrome-plated brass fittings and stay-open ball valve, with stainless steel ball and stem.
 3. Universal emergency sign mounted on stainless steel ball valve paddle.
 4. Test card to record weekly checks.
 5. Emergency Fixture Tempering Valve.
 6. Acceptable manufacturers and models:
 - a. Haws.
 - b. Bradley.
 - c. Speakman.
- B. Emergency Fixture Tempering Valve: ANSI Z358.1-2009 compliant and ASSE 1071 listed emergency fixture tempering valve. Provide one tempering valve per emergency fixture. Cold water bypass when hot supply lost; shut-off of hot supply when cold supply lost; shut off hot and allow cold flow if thermal actuator fails.
1. Select valve to control accurately across the entire flow range of the emergency fixture. Tempering valve pressure drop shall not exceed 10 PSI at the emergency fixture's maximum flow rate.
 2. Tamper resistant temperature adjustment, range 65 deg. F to 95 deg. F, factory set at 85 deg. F.
 3. Rough bronze finish. Brass and stainless steel internal components.
 4. Chloramine resistant seals.
 5. Integral check valves and stainless steel strainers (screens) in hot and cold water inlet connections.
 6. Provide thermometer to measure the mixed temperature, range 0-140 deg. F. Thermometer may be integral to tempering valve or field supplied.
 7. Approved manufacturers:
 - a. Haws
 - b. Bradley
 - c. Powers Hydroguard XP
 - d. Leonard Valve Company

2.13 GARBAGE DISPOSAL

- A. Garbage Disposal:
1. Corrosion proof polymer or stainless steel hopper and grinding chamber.
 2. Compact shell, 14 in. maximum overall height. Sound insulated.
 3. Stainless steel grind ring, swivel impellers, and turntable.

4. Motor: 3/4 HP, 120V single phase permanently lubricated. Built-in overload protection with manual reset.
5. Stainless steel 3-bolt sink flange connection, stainless steel stopper, and dishwasher drain connection.
6. For operation with wall switch (continuous feed).
7. Acceptable manufacturers and models:
 - a. Insinkerator Evolution Series.

2.14 ACCESSORIES

- A. All exposed metal parts of all fixtures, including faucets, waste fittings, indirect waste piping, waste plugs, strainers, flush valves, traps, supplies, and escutcheons shall be chrome-plated brass, unless otherwise specified. (This includes all parts within a base cabinet).
- B. Acceptable manufacturers:
 1. Watts
 2. Chicago.
 3. BrassCraft.
 4. Faucet manufacturer.
- C. Fixture Stops
 1. Fixture stops shall be the commercial quality chrome plated with brass stems. Stops shall have solder connection on the water supply inlet and compression fittings on the fixture side of the stop. Stop handles to be full wheel type with brass handles.
- D. Fixture Supports & Carriers
 1. All fixture supports shall be ANSI approved to adequately support the fixture. The contractor shall select the type of carrier which will best suit the fixture arrangement, wall space available for the piping arrangement and materials employed.
- E. Shower mixing valves to be anti-scald type with limit stops to meet current codes.
- F. All mixing faucets which could receive a hose connection and all shower mixing valves are to be provided with back check valves unless design of the faucet precludes the possibility of backflow or crossflow.

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before fixture installation. Verify that walls and floor finishes are prepared and ready for installation of fixtures.
- B. Review millwork/casework shop drawings. Confirm location and size of fixtures and openings before rough-in and installation. Confirm that millwork/casework is constructed with adequate provision for the installation of countertop lavatories and sinks.
- C. Coordinate cutting and forming of roof and floor construction to receive drains to required invert elevations.

3.2 INSTALLATION OF PLUMBING FIXTURES - GENERAL

- A. Fixtures shall not be used for construction activities. Protect fixtures from damage during construction.

- B. All fixtures shall be installed to meet manufacturer's recommendations and local codes.
- C. Unless otherwise noted, fixture rough-in shall be at manufacturer's listed heights. Note special rough-in requirements for handi-capped person fixtures. Meet all requirements of the ADA regarding installation heights and clearances.
- D. Provide a fixture stop on each supply to each fixture. This includes such items as water fountains and rough-in provisions for vending machines, etc.
- E. Install fixture supports securely to building substrate, utilizing bolts in every mounting hole provided in the fixture support. Provide additional blocking/backing when required.
- F. Install Barrier Free water closets, urinals, lavatories, and other devices at mounting heights and with clearances in conformance with the applicable Building Code and ADA requirements.
- G. Install supply, vent and drain connections to fixtures full size of fixture connection, unless larger required by code or indicated otherwise on drawings.
- H. Install fixtures and fixture carriers level and plumb.
- I. Countertop Lavs: Coordinate with architectural trades.
- J. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations and within cabinets and millwork. Install deep-pattern escutcheons if required to conceal protruding fittings.
- K. Install each fixture with trap, easily removable for servicing and cleaning.
- L. Provide flexible fixture piping to all lavatories and sinks.
- M. Provide accessible ball type isolation valves (construction per Related Section) in the supplies to shower control valves and electric water coolers.
- N. Provide accessible ball type isolation valves and spring check valves (construction per Related Section) in the supplies to service sink faucets. These check valves are in addition to checks integral to the faucet. Locate isolation valves to isolate faucet and checks.
- O. Provide plumbing fixtures complete with supply, waste and vent piping connections; together with all fittings, supports, fastening devices, and valves.
- P. Use strap wrenches and padded tools to preclude injury to chrome plated and other decorative surfaces.
- Q. Exposed to view supply and drainage trim for fixtures and equipment shall be connected to the rough piping systems at the wall, unless noted otherwise.
- R. Wall sleeves on supply and drain connections are not required at the immediate connection to plumbing fixtures. Provide escutcheons.
- S. For faucets without an included gasket, seal areas between faucet base and sink top with non-hardening plumber's putty.
- T. Seal joints between plumbing fixtures and walls and floors using mildew-resistant 100% silicone sealant. Match sealant color to fixture color. Use sealing compound, such as Dow #784 white silicone sealant, for the following installations:
 - 1. Rims and trim of stainless steel sinks and drop-in lavatories.
 - 2. Between the wall and the outer edge of wall-hung water closets and urinals.
 - 3. Between the wall/floor and the adjoining edge(s) of mop sinks.
 - 4. Between the floor and the bottom circumference of floor-mounted water closets.
- U. Install emergency fixture placards at approved location.

3.3 INSTALLATION OF WATER CLOSETS AND URINALS - STANDARD AND BARRIER FREE

- A. Mounting Heights:
 - 1. Water closets - standard: 15 in. to 17 in. from top of toilet seat to finished floor.
 - 2. Water closets - barrier free: 17 in. from top of toilet seat to finished floor.
 - 3. Flush Valve: Mount flush valve handle on wide side of stall or room.
- B. Apply dual flush instruction plates to wall centered above flushometer.
- C. Install toilet seats on water closets.

3.4 INSTALLATION OF FIXTURES IN CASEWORK

- A. Fixtures (including tailpiece) and outlets to be installed in shall be furnished and installed by this contractor as part of the work under this section. Contractor shall install fixtures and outlets complete including all piping, supports, stops, etc. Contractor shall provide rough-in and shall make all final connections. Contractor shall coordinate his work with casework manufacturers and with all other trades. Refer to Plumbing drawings for location and quantities of outlets and fixtures and for piping details.

3.5 INSTALLATION OF THERMOSTATIC MIXING VALVES (NON-EMERGENCY FIXTURES)

- A. Install in a location readily accessible for cleaning, adjustment, and valve/cartridge replacement.
- B. Install mixing valve after checks and stops are installed. Thoroughly flush all piping immediately prior to mixing valve installation.
- C. Install isolation valves on the hot and cold water inlet pipe connections, near the mixing valve.
- D. Install check valves between the mixing valve and the mixing valve isolation valves. These check valves are in addition to the mixing valve's integral check valves.
- E. Adjust valve temperature set point to 115 deg. F, following manufacturer's adjustment instructions.

3.6 INSTALLATION OF EMERGENCY FIXTURE TEMPERING VALVES

- A. Install in a location readily accessible for cleaning, adjustment, and valve/cartridge replacement.
- B. Install tempering valve after checks and stops are installed. Thoroughly flush all piping immediately prior to tempering valve installation.
- C. Install isolation valves on the hot and cold water inlet pipe connections, near the mixing valve.
- D. Install check valves between the mixing valve and the mixing valve isolation valves. These check valves are in addition to the tempering valve's integral check valves.
- E. Install individual fixture tempering valves a maximum of 10 feet from the emergency fixture served, closer if recommended by the manufacturer.
- F. Install a downstream thermometer with a range of 0-140 deg. F, to measure the mixed temperature. Not required if tempering valve is supplied with an integral thermometer.
- G. Remove isolation valve handles.
- H. Adjust valve temperature set point to 85 deg. F +/- 3 deg. F, or as indicated on drawings. Follow manufacturer's adjustment instructions.

3.7 COMMISSIONING

- A. Perform the commissioning activities as outlined in the Division 01 Section for Commissioning and other requirements of the Contract Documents.

3.8 ADJUSTING AND CLEANING

- A. Flush all water closets and urinals and verify performance. Adjust or clean flush valves to produce proper flow.
- B. Back-flush shower heads, faucet aerators/spray heads, and in-line strainers at electric water coolers, emergency fixtures, and wherever installed, and reinstall.
- C. Adjust pop-up drains for proper operation.
- D. Adjust eyewashes to provide proper flow.
- E. Adjust shower control valve limit stops to deliver maximum 113 deg. water.
- F. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise or overflow.
- G. Replace dead batteries in sensor operated flush valves and faucets. Adjust sensor operation to satisfaction of commissioner.
- H. At completion of project, remove excess caulk and sealants and clean plumbing fixtures and equipment.

END OF SECTION 224000

DIVISION 23 – HEATING VENTILATING AND AIR CONDITIONING

SECTION 230000 - GENERAL PROVISIONS FOR HVAC WORK

PART 1 GENERAL

1.1 BIDDING

- A. The Contractor shall provide labor, materials, equipment, items, articles, operations and methods listed, shown, scheduled, or mentioned on the drawings, and/or specified, including all incidentals required for their completion.
- B. The Contractor shall refer to the General part of these specifications, such as Instructions to Bidders, Special Conditions and DIVISION 1 for restrictions covering time that work can be performed in certain areas, noisy and dusty operations, sequence of work, access to restricted areas and similar types of work and operations.

1.2 SUBSTITUTIONS

- A. Most items in this DIVISION are eligible for substitution in accordance with the General Conditions and Supplements thereto. Where a proprietary specification is written for a particular item, then only that item may be used. All items eligible for substitution require submission of request for substitution 10 days prior to bid date. This submittal shall include specific models and capacities of equipment and not just manufacturer's literature.
- B. When the Engineer deems it necessary, to assure satisfactory installation and compatibility with other equipment, piping, ductwork, electrical provisions and other appurtenances, the Contractor shall prepare scale drawings of the substitute item showing proposed location, connections, relation to other equipment and other pertinent data such as maintenance space requirements, electrical requirements, height and weight. Drawings must receive Engineer's approval before the substitution is made.
- C. It is the Contractor's responsibility that the substitute item shall fit into the space allocated and that the item can be installed and function as intended. Should changes in the work of any Contractor become necessary as a result of any substitute item under this DIVISION, such changes shall be arranged and paid for by this Contractor.
- D. Capacities of substitute items shall not be less than that of the specified item.
- E. The performance of the factory representative and supplier on past work will be a consideration in the approval process of substitute items.
- F. The final decision as to acceptability rests with the Engineer.

1.3 CODES, REGULATIONS AND PERMITS

- A. All materials and equipment shall be new, approved by the governing authority, and be in new, undamaged condition when installed.
- B. Comply with the International Mechanical Code, National Fire Protection Association Fire Codes, Uniform Plumbing Code, International Building Code, and all other applicable Federal, State, County and City codes, regulations and ordinances. Comply with DIVISION 16 and all codes referenced therein for any and all electrical work accomplished under this Division or by this Contractor.

- C. Arrange for and obtain all permits and approvals required for the execution of the work.

1.4 WORKMANSHIP

- A. Work shall be accomplished by workmen skilled in the particular trade, in conformance with best practices and to meet all applicable codes.
- B. The Engineer decides where work is satisfactory. This Contractor shall replace materials or equipment not properly installed or finished, without increase in payment received.

1.5 RESPONSIBILITY

- A. The Contractor is responsible for installation of a satisfactory and complete piece of work in accordance with true intent of the drawings and specifications.
- B. Consult all drawings for the project to predetermine that the work and equipment will fit as planned.
- C. The location of piping, ducts, equipment, etc., shall be checked to ensure clearance from openings, structural members, cabinets, lights, outlets, and equipment having fixed locations. This shall be accomplished prior to fabrication of pipe or ducts.
- D. If, at any time, and in any case, changes in location of piping, ducts, equipment, etc., becomes necessary due to existing obstacles or installation of other trades shown on any of the project drawings such required changes shall be made by the Contractor at no extra cost. These changes are to be recorded on the record drawings.
- E. This Contractor is responsible to provide all incidental electrical interconnections, control wiring, etc., which are necessary for system completion and which are not specifically shown or otherwise indicated on the electrical drawings or specified in DIVISION 16.
- F. All electrical work incidental to or accomplished under this Division shall comply with all requirements of DIVISION 16.

1.6 DELIVERY AND STORAGE OF MATERIALS

- A. Make provisions which are acceptable to the Owner and Engineer for delivery and storage of materials.
- B. Make provisions for introduction into the building of equipment furnished under this DIVISION.
- C. Refer to DIVISION I for additional provisions to allow equipment passage into the building.

1.7 MANUFACTURER'S DIRECTIONS

- A. Manufactured materials and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned as directed by the manufacturer unless noted otherwise herein or on the drawings.

1.8 CUTTING, PATCHING, REPAIRING

- A. Cutting, patching and repairing required by the work of this DIVISION shall be the responsibility of this Contractor.
- B. Work shall be performed in accordance with DIVISION 1 of these specifications.

- C. The performance of this work shall not weaken the structural integrity of the building.
- D. Any abrasion or disfigurement of the finished work or any portion of the building where any such abrasion or disfigurement is caused by the activities of the Contractor shall be repaired and neatly refinished to match the adjacent work.

1.9 OPENINGS IN PIPES AND DUCTS

- A. Openings in pipes and ducts shall be kept closed during progress of work.
- B. The Contractor is required to clean new systems found dirty to the satisfaction of the Engineer at no additional cost.

1.10 CLEANUP

- A. Upon completion of work, remove materials, scraps, etc., relative to this work and leave the premises in a clean and orderly condition. This applies equally to finished, unfinished and concealed spaces.
- B. Clean equipment of dirt and debris.

1.11 FIRE PROTECTION

- A. Metallic pipe, duct and other penetrations of all fire partitions, walls and floors shall be effectively fire-stopped to equal the fire rating of the floor or partition using materials and methods UL approved and tested to meet all conditions of ASTM E119, UL 1479 and ASTM E 814 tests. One such material is Carborundum bulk "Fiberfrax" fiber packing for filling the annular space between pipe and sleeve or hole and Fiberfrax LDS moldable caulking for sealing in the fiber packing. Other acceptable materials are Dow Corning 3-6548 Silicon RTV foam firestop system, General Electric 'Pensil' 851 system or U.S.G. fire code compound and Thermafire.
- B. PVC pipe penetrations to be fire stopped same as metallic penetrations with the addition of an intumescent wrap to effectively close the hole if PVC vaporizes.
- C. Construction of permanent bracing, framing, roof curbs and platforms or other structures which utilize wood construction shall be fabricated from fire resistant treated materials or shall be otherwise protected by approved fire resistant materials.

1.12 COMPLETION AND TESTS

- A. Complete and test each system as specified. Leave all systems in proper operation.
- B. Prior to the contractor's request for a substantial completion inspection, a system demonstration shall be performed in the presence of the Engineer and owner's designated representatives. During the test the contractor shall demonstrate that all systems perform in the manner described in the specifications and indicated on the drawings. Test procedure and the results shall be recorded and delivered to the Owner. Tests shall be repeated after any corrections are made as a result of initial testing of correctional work under guaranteed provisions.

1.13 OPERATING INSTRUCTIONS, OWNERS TRAINING

- A. After system demonstration has been completed and system corrections made, the Contractor shall provide qualified personnel to instruct the Owner's maintenance personnel in the operation and maintenance of all new systems and equipment. Allow for 2 hours of on-site training for each trade including HVAC, plumbing, controls and electrical.

- B. Written operation and maintenance instructions, as produced by the manufacturer, shall be provided for all equipment. These instructions shall be bound and submitted as described in this Section.

1.14 RECORD DRAWINGS

- A. A separate set of mechanical drawings shall be maintained at the job site at all times and shall be used as record drawings. This set shall be kept up to date with all changes and/or additions in the construction and/or mechanical systems, and shall be delivered to the Engineer at the completion of this job. This set of drawings shall be kept clean and protected at all times.

PART 2 SUBMITTALS AND BROCHURES OF EQUIPMENT

2.1 GENERAL

- A. The information required to be submitted and approved in order to fulfill the requirements of this DIVISION falls into two general categories. These are the "Brochures of Equipment" and "Submittals."
 - 1. The "Brochures of Equipment", as the name implies, shall contain all pertinent information for all equipment installed. This information is required to be turned over to the Owner and approved before final payment is authorized. Special training for certain equipment may require the use of this book at an earlier stage of project completion. In these instances, the Contractor will be required to prepare and submit the applicable portions of the Brochures of Equipment significantly before project completion.
 - 2. "Submittals" is a general term for informational literature which must be supplied to and approved by the Contractor prior to installing, receiving, or in some instances, even ordering equipment. The normal required types of submittals include shop drawings, manufacturer's literature, installation and operation instructions (from the manufacturer) and wiring diagrams. System reports, such as start-up reports or balancing reports, and the Project Completion Checklist are two forms of submittals which are required after the equipment has been installed and is operational. Each Section of this Division may contain special or more specific requirements for expanded or additional types of submittal literature. These shall be provided as required by each Section.
 - 3. In general, information from the approved submittals shall be included in the Brochures of Equipment. These books shall also include complete operation and maintenance literature for each piece of equipment such as may be packaged with the equipment for OEM components. They will be used by the Owner's personnel as the primary source of information for operating and maintaining the installed systems and as such, they shall exhibit a high degree of clarity, thoroughness and be suitably bound and arranged to be useful and durable throughout the life of the installed systems.

2.2 SUBMITTALS

- A. The contractor shall procure manufacturer's literature for all items of equipment, materials or systems on the job. Information shall be complete and marked showing name of job, item used, size, dimensions, capacity, rough-in, etc., as required for complete check and installation. Any exceptions of the equipment being furnished from that specified shall be clearly defined. Specific requirements of submittals may be expanded in individual specification sections. Minimum requirements shall include the following:
- B. Submit actual installation layout drawings on floor plans showing pipe and duct runs. Provide such drawings for systems such as underground pipe and boiler flue systems.

- C. Manufacturer's information shall include any and all restrictions on the application and installed service limitations of the product.
 - 1. Submittals for any piece of equipment shall be forwarded to the owner or Engineer (as designated) for review. This submittal shall be made within 30 days of award of contract or specified item shall be furnished. The Contractor shall check submittals for adequate identification, correctness and compliance with drawings and specifications and apply his stamp of approval before forwarding the submittal. Submittals shall be revised, changed and/or resubmitted until acceptable and approved by the Owner's representative.
 - a. Approval of submittals and literature by the owner or Engineer shall not relieve the Contractor from responsibility for deviations from drawings or specifications, nor shall it relieve him from responsibility for errors in shop drawings or other submittal literature.
 - b. All submittals shall be distributed in PDF or JPEG format. Hard copies are not desired unless samples or scaled drawings are necessary for review.
 - 1) Submittals may be made using email or compact disk.
 - 2) Submittals shall be labeled by equipment type and indexed by specification section.

2.3 BROCHURES OF EQUIPMENT

- A. The Contractor shall prepare two compact disks containing the brochures of equipment in electronic format. Each shall contain all required submittal data for the construction materials and each piece of equipment (reference Submittal Schedule, 15000 2.03) installed under this project. The literature required for submittal purposes shall be expanded to include operation and maintenance literature for each piece of equipment. Maintenance information shall be complete in every respect and shall include parts lists and assembly drawings wherever applicable.
- B. All literature shall clearly indicate the equipment it represents and shall be labeled with the equipment identification abbreviation found on the drawings, e.g. EF-1, etc. All information which is not applicable to the particular model and size supplied shall be clearly and neatly crossed out with heavy black marker or other suitable means. This includes dimensional drawings, maintenance information, parts lists, wiring diagrams, etc. Only the information applicable to the particular equipment supplied shall remain and it shall be easy to follow. Booklets not meeting these requirements shall be returned for correction.
- C. Authorization for final payment shall not be made prior to final acceptance of the Brochures of Equipment.

End of Section

SECTION 230593 - TESTING, ADJUSTING AND BALANCING

PART 1 GENERAL

1.1 DESCRIPTION / WORK INCLUDED

- A. Testing, adjusting and balancing (TAB) of heating, ventilating and air conditioning (HVAC) air systems.
- B. Work includes balancing of all fancoils, make up air systems and roof exhaust fans and associated air terminals.
- C. Testing, adjusting and balancing of other systems as may be directed under PART 3: EXECUTION.
- D. Definitions:
 - 1. Basic TAB terms used in this Section: Chapter 34, "Testing, Adjusting and Balancing" of the 1991 "HVAC Applications" ASHRAE Handbook.
 - 2. TAB: Testing, Adjusting and Balancing. The process of checking and adjusting HVAC systems to meet design objectives.
 - 3. AABC: Associated Air Balance Council.
 - 4. NEBB: National Environmental Balancing Bureau.
 - 5. Air Systems: All supply air, return air, exhaust air and outside air systems.

1.2 QUALITY ASSURANCE

- A. Qualifications of the TAB contractor.
 - 1. All TAB procedures shall be performed by a firm which is engaged in this type of work as their primary business. The firm must be independent from contractor performing other work or services on this contract.
 - 2. The Contractor shall submit the name and credentials of the TAB firm for review and approval within 30 days after signing the construction contract.
 - a. The TAB firm shall provide qualifications of the firm and of both the individual who is to do the test and balance. Provide proof of completed balancing work on at least five projects of similar size and scope, along with a list of references which may verify qualifications.
 - b. Final approval of the TAB firm will be at the Engineer's discretion, based on the information submitted.
 - c. The TAB firm shall be completely independent and shall not be involved in temperature control contracting or mechanical engineering.

1.3 SUBMITTALS

- A. Submit the TAB firm's credentials for approval not less than 30 days after the construction contract is signed.
- B. After completion of all tests, submit a complete TAB report for approval. Where test results differ from specified design conditions, indicating a system deficiency, include explanatory

comments in the report. The Contractor shall submit the final TAB report prior to requesting final inspection for the project. The format of the report shall be as described in PART 3 of this Section.

PART 2 TEST APPARATUS

- A. Instrumentation used for TAB procedures shall be professional quality and shall meet the performance ranges and accuracies listed below. All instruments shall have been calibrated not more than 12 months prior to use on this project.
 - 1. Thermometers: 0°-220°F range, accuracy within 1/2 scale division.
 - 2. Humidity instruments: 0-90% RH, accuracy within $\pm 2\%$ RH.
 - 3. Pressure gauges - air systems
 - a. 0-.5 in. w.c., accuracy within .01" w.c.
 - b. 0-1.0 in. w.c., accuracy within .02" w.c.
 - c. 0-5.0 in. w.c., accuracy within .20" w.c.
 - 4. Pressure gauges, hydronic systems
 - a. 0-30 psi, accuracy within $\pm 1\%$ full scale.
 - b. 0-60 psi, accuracy within $\pm 1\%$ full scale.
 - c. 0-200 psi, accuracy within $\pm 1\%$ full scale.
 - 5. Anemometers (air velocity): 100-300 fpm, accuracy within $\pm 10\%$.
 - 6. Flow hoods: 0-1400 cfm, accuracy within $\pm 5\%$.
 - 7. RPM gage: 0-3000 rpm, accuracy within $\pm 2\%$.

PART 3 EXECUTION

3.1 GENERAL:

- A. Coordinate TAB procedures with any phased construction requirements for the project so that increments of finished work may be accepted for beneficial occupancy.
- B. The TAB firm shall review the systems during construction and instruct the Contractor on any modifications or system appurtenances which may need to be included in the system in order to achieve final balance.
- C. Allow sufficient time in the construction schedule for TAB procedures to be carried out prior to final inspection for the project.
- D. Conduct TAB procedures only after each system has been completed and is in full working order. Put all HVAC systems into full operation and continue operation of the systems during each working day TAB procedures are being conducted.
- E. TAB contractor to procure manufacturer's fan and pump curves for the equipment installed and shall include the curves, marked to show final operating status with the TAB report.

3.2 TEST AND BALANCE

- A. Balance all air distribution systems to design values. TAB procedures shall be carried out when

all systems are operating concurrently.

1. Adjust diffusers to design air quantities and record the final status of each.
2. Adjust maximum and minimum primary air quantities on all fan terminal units. Adjust the fan speed to produce the required design secondary airflow.
3. Adjust the operating speeds of all fans as necessary to achieve design air flow. Fan speed adjustment shall be performed when the system is operating at peak load and all inlet vanes and downstream volume control dampers are wide open.
4. Adjust fresh air quantities on all air handlers to the values indicated on the drawings or as directed by the Engineer.
5. All fans and air handlers, where applicable, shall be balanced and tested with new, clean filters in place and with the outside air damper open to the minimum ventilation setting.
6. With the fan speed adjusted and operating to produce design air flow, measure and record the static pressure across each component of all fans and air handlers. Data shall include the upstream and downstream pressures in the ducts connected to each unit, the pressure drop and static pressure across all dampers, filters, coils, etc., and the total static pressure developed across the fan only.
7. The final report data for all air handlers and all belt-driven unitary or cabinet fans over 1/3 hp shall include the final fan speed, fan size, motor frame size and horsepower, electrical ratings and characteristics of the motor, measured and rated amperage draw on each phase, fan and motor sheave make, model and size and complete manufacturer's nameplate data.

B. Test Temperature Control System

1. The temperature control system test and report shall be performed by the temperature control contractor.

3.3 REPORT

- A. The Contractor shall submit a report to the A/E listing the airflow for all supply and return air registers, diffusers, etc., and shall certify to their correctness. The report shall include drawings which show the diffusers, registers, etc., to identify locations and diagrams of air handling systems to show arrangement of components and test point. The report shall include the final status of all equipment, including operational attitude of controls, fan rpm, component static pressures, ampere draw, and fan and pump curves marked, and a description of any peculiarities encountered in the system.
- B. All information shall be bound into a single report beginning with a title sheet indicating the project title and location, the date(s) the TAB procedures were carried out and the firm name and signature of the individual responsible for the work.
- C. Data shall be submitted on forms similar to those produced by the NEBB for each type of equipment. All applicable data shall be filled in, including nameplate data for all motors and fans, sheave and belt sizes, actual measured amperage draw, etc. Equipment shall be identified with the same abbreviation as listed on the plans (e.g. EF-1, SD-2, etc.).

End of Section

SECTION 230700 – DUCT INSULATION

PART 1 GENERAL

1.1 RELATED DOCUMENTS AND STANDARDS

- A. Drawings and general provisions of the Contract, Standard General and Supplementary General Conditions, Division 1 Specification Sections, and other applicable Specification Sections including the Related Sections listed below, apply to this Section.
- B. All work and materials shall be furnished and installed per ASHRAE 90.1 (Latest).

1.2 SCOPE OF WORK:

- A. Insulate ductwork and equipment unless indicated as not to be insulated in paragraph 1.4.

1.3 SUBMITTALS

- A. Provide manufacturer's literature and ratings for all pipe and duct insulation products. Data shall include fire and smoke ratings, thermal conductivities, recommended temperature limitations, perm ratings of jackets and materials of construction.
- B. Submittals shall be clearly marked to indicate what insulation and cover is to be used, insulation thickness and which system is to be insulated with each product.

1.4 ITEMS NOT TO BE INSULATED:

- A. Equipment: Factory insulated equipment.
- B. Ductwork: Exhaust air ductwork located upstream of backdraft dampers. (Ductwork between backdraft damper and exterior to be insulated)

1.5 FIRE RATINGS

- A. All products used shall be UL listed with a maximum flame spread rating of 25 and maximum smoke development rating of 50.

PART 2 PRODUCTS

2.1 GENERAL INSULATION DEFINITIONS:

- A. Insulation thermal conductivity: No greater than value listed, in Btu-inch/hour-square foot-degrees F at 75 degrees F mean temperature.
- B. Water Vapor Permeance (ASTM E97 or E96, Procedure A): No more than value listed, in perms. Water vapor permeability (ASTM C355): No greater than value listed, in perm-inch.
- C. Puncture resistance (ASTM D781): No less than value listed.
- D. Flame spread classification (ASTM E84, NFPA 255): No greater than value listed. Smoke density classification (ASTM E84, NFPA 255): No greater than value listed. Composite listing includes insulation, jacket, and adhesive.
- E. Density no less than value listed, in pounds per cubic foot.

2.2 ACCEPTABLE PRODUCTS

- A. Equivalent products of Armstrong, Johns-Manville, Knauf, Certainteed, and Owens-Corning are acceptable.
- B. Owens-Corning catalog designations and descriptions used herein.

- C. Substitute insulation shall provide same thermal and mechanical protection as the insulation specified.

2.3 DUCTWORK INSULATION - INDOOR, CONCEALED

- A. Install on all exhaust air ductwork between backdraft damper and building exterior.
- B. Install on all outside air intake ductwork.
- C. In ceiling spaces, mechanical rooms, building shafts, and other locations where not visible, insulate ductwork with 1-1/2" thick, blanket-type, fiberglass insulation with factory-applied vapor barrier, and 2" stapling and taping flange along one edge. Insulation: ASTM C553, density of 0.75, conductivity of 0.32. Vapor barrier: laminated white kraft paper, aluminum foil, glass fiber reinforcement, permeance of 0.02, and puncture resistance of 50 units. Composite flame spread/ smoke density of 25/50.
- D. Manufacturers: CertainTeed - Type 75 FSK Standard Duct Wrap; Schuller - R Series Microlite with FSKL; Knauf - Duct Wrap with Multi-Purpose FSK; Owens/Corning - All Service Faced Duct Wrap

2.4 INTERIOR ACOUSTICAL DUCT INSULATION

- A. Install in all return and supply air ductwork.
- B. Interior acoustical lining - Aeroflex bonded mat fiberglass duct liner type 200, 1/2" thick, black coated, for up to 6000 fpm velocity. Product to meet NFPA 90 standards for flame spread and smoke development and federal spec. MIL-I-22023C, types I & II.

PART 3 EXECUTION

3.1 INSULATION INSTALLATION

- A. All systems shall be tested and approved before being insulated.
- B. The insulation shall be applied over clean, dry surface.
- C. Full lengths of insulation shall be used except at end of straight sections and as required to accommodate fittings. Insulation shall be applied with the joints tightly fitted together. Cracks or voids shall be filled with insulation. Manufacturer's recommended installation procedures shall be strictly adhered to.
- D. The edges and seams at all visible locations shall be finished in a neat and workmanlike manner.
- E. All exposed ductwork insulation shall be applied with edges butted. Insulation shall be impaled over stick clips or pins welded to the duct, and secured with speed clips. Spacing of pins shall be as required to hold insulation firmly in place but not less than one pin per square foot. All joints and penetrations of the vapor barrier shall be sealed with a 3" wide strip of the same material, supplied with vapor barrier adhesive to both surfaces as recommended by adhesive manufacturers.
- F. Blanket insulation shall be tightly sealed at all joints and seams. Insulation shall be cut longer than ductwork perimeter to allow maximum thickness on all areas and avoid excessive compression. All joints shall be over lapped at least 2" and stapled in place. The stapled seams shall be sealed with a minimum 3" wide pressure sensitive tape designed for use with the duct insulation. All breaks in the vapor barrier facing shall also be sealed with the tape. The underside of ductwork 18" or greater in width, and vertical surfaces 48" or greater shall have the insulation additionally secured with mechanical fasteners and speed clips spaced approximately 12" on center. The protruding ends of the fasteners shall be cut off flush after the speed clips are installed, and then sealed with the same tape as specified above.

- G. Termination of insulation at equipment, unions, etc., shall be neat without any raw edges. Bevel insulation and cover each end the same as a fitting.
- H. Vapor barrier jackets on all cold and dual temperature pipes and ducts shall be continuous. Repair all punctures, flaps, etc., correctly and effectively.
- I. Duct liner:
 - 1. All portions of duct systems shown or specified to receive duct liner shall be completely covered with no gaps or interruptions. The liner shall be fully adhered to the duct surface with 100% coverage of an insulation adhesive which complies with ASTM C916. The liner shall be additionally secured with mechanical fasteners on 15" centers. All transverse edges and joints shall be coated with adhesive.
 - 2. Duct sizes shown are net interior sizes. Increase the outside dimensions of the ductwork to accommodate the insulation.
- J. Finished installation shall provide a continuous and effective vapor barrier.

END OF SECTION 230700

SECTION 231113 - NATURAL GAS PIPING SYSTEM

PART 1 GENERAL

1.1 CODE COMPLIANCE

- A. System shall be in accord with City and State Codes and NFPA Standard No. 54.
- B. Installation and materials shall also be in accordance with International Fuel Gas Code, American Gas Association recommendations, and the local utility company regulations.

1.2 SERVICE

- A. Contractor shall arrange for and coordinate gas service modifications with the utility company. Contractor shall also arrange for meters and regulators to meet capacities and pressures shown on the drawings.

PART 2 PRODUCTS

2.1 PIPING

- A. Interior gas piping shall be Schedule No. 40, ASTM Specification A-53, black steel.
 - 1. Low pressure pipe (less than 14" w.c.) assembly up through 2" size shall be with banded screwed fittings, butt-welded fittings or socket-welded fittings.

PART 3 EXECUTION

3.1 CONNECTIONS

- A. Connect up all gas appliances.
- B. Provide dirt leg, shutoff cock and union on all appliance connections.

3.2 TESTS

- A. Test system as required by the International Fuel Gas Code and NFPA.

End of Section

SECTION 233113 - DUCTWORK AND ACCESSORIES

PART 1 GENERAL

1.1 WORK INCLUDED

- A. Furnish and install all sheet metal duct systems as indicated on the plans or herein described.
- B. Furnish and install all grilles, registers, diffusers, louvers, dampers and ductwork accessories as shown on the plan or herein described.

1.2 QUALITY ASSURANCE

- A. Duct construction shall be in accord with the requirements of the two following organizations and good industry practice.
 - 1. Various applicable manuals and standards of the Sheet Metal and Air Conditioning National Association (SMACNA) such as: HVAC Duct Construction Standards, Round and Rectangular Industrial Duct Construction Standards; Duct Liner Standards; Fibrous Glass Duct Construction Standards.
 - 2. Material and duct construction standards of the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE).

1.3 CODES

- A. Materials, methods and installation shall also be in accord with the applicable requirements of the National Fire Protection Association (NFPA) Standards 90A and 90B.

1.4 SUBMITTAL DATA

- A. See Section 15000 for general submittal requirements.
- B. Submit complete manufacturer's literature for all duct accessories.
- C. Submit manufacturer's literature and performance data for all grilles, diffusers and registers. Identify all materials of construction and the options and accessories which will be furnished with each unit. Performance data shall include throw, pressure drop and NC information. Performance data is not required for units supplied as specified.
- D. Submit complete manufacturer's literature and performance data for all louvers and penthouses. Identify all materials of construction and the options and accessories which will be furnished with each unit. Performance data shall include pressure drop, free area and water penetration curves. Submit data for all roof curbs supplied with penthouses.
- E. Submit complete manufacturer's literature, including installation instructions for all dampers. Submit AMCA leakage ratings for all mixing and shut-off dampers.

PART 2 PRODUCTS

2.1 DUCTS

- A. Square or rectangular ducts for HVAC systems and similar uses shall be constructed of galvanized sheet steel unless otherwise specified or noted on the drawings. Materials gauges (thickness) to be in accord with the SMACNA and ASHRAE standards listed above.

B. SEALING OF DUCT JOINTS

1. All joints and seams of ductwork and fittings shall be sealed air tight with the joint sealing materials specified herein or with an approved substitute product. Unless otherwise indicated on the plans, all rectangular ductwork shall be constructed to 2" water gauge pressure class standards. Duct systems so indicated on plans shall be constructed to higher pressure class standards. Minimum wall thickness for all rectangular ducts shall be 26-gauge unless a heavier minimum gauge is required by the listed SMACNA standards due to duct dimensions or pressure class. Transverse joints and reinforcements shall be constructed, sized and spaced in accordance with SMACNA standards for the duct dimensions, wall thickness and pressure class of duct employed.
2. Sealant shall be Proseal as manufactured by Ductmate or approved equal.

C. Round or Oval Spiral Duct

1. Round duct shall be Spiral seam. Duct shall be fabricated from galvanized steel meeting ASTM A-527 standards. Gauges shall be the following minimums:

<u>Diameter</u>	<u>Gauge</u>
3" - 14"	26
15" - 26"	24
27" - 36"	22

2. Fittings to be welded joint construction with mitered or formed construction. 90° elbows with minimum 5-piece construction. Branch line tees to be separate fittings, conical or straight as indicated.
3. Joining and hanging of pipe and fittings to utilize flanged angle rings such as United McGill 'uni-ring.'

*At contractor option: Low pressure spiral seam round ductwork (no greater than 12" diameter) may be substituted with snap lock type duct systems for non-exposed (non-visible). Adjustable elbows on low pressure systems is acceptable.

- D. Flexible duct shall be Thermaflex Type M-KE or as approved. Duct shall be in accord with NFPA 90A requirements and shall be UL approved and rated for flame spread less than 25 smoke development not more than 50. Pressure rated for 6 inches WG. Flexible duct shall be insulated with an R value of not less than 4.3 and shall be manufactured with a fiberglass reinforced vapor barrier jacket.

2.2 DUCT ACCESSORIES

- A. Equivalent products of Elgen, Young, Duro-Dyne, Cesco or Ventfabrics are acceptable.
- B. Duct turning vanes - single vane with trailing edge as per SMACNA Fig. 2-3.
- C. Flexible connections - Ventfabric's Ventglas or as approved. Fabric width necessary to provide 4" metal-to-metal separation.
- D. Ruskin Model #ADC3 "see-thru" type with cam type closers. Use the largest standard square size acceptable by the duct unless otherwise specified or noted on the drawings.
- E. Instrument Test Holes (I.T.H.): Unless otherwise detailed or noted on the plans, an instrument

test hold shall consist of a 5/8" diameter hole drilled and deburred in the duct with plastic snap-in closure plug.

- F. High Efficiency Takeoffs: Sheet metal connectors, without volume damper.
- G. Volume dampers - opposed blade type damper with locking quadrants.

2.3 GRILLES, REGISTERS, DIFFUSERS

- A. Equivalent products of Metal Aire, Krueger, Carnes, Anemostat, or as approved.
- B. All units shall be furnished and installed complete with the necessary accessories such as gaskets, frames, screws, key operators, for a satisfactory installation. All grilles which are to install directly to ceiling or gypsum wall board surfaces (without duct connections) are to be provided with mounting frames on the opposite side of the ceiling or wall surface.
- C. Sizes, materials, types and finishes shall be as noted in the schedules.

2.4 LOUVERS

- A. Equivalent products of Carnes, Cesco, Airolite, Airstream, Ruskin, United Sheet Metal, American Warming & Ventilating, Perfco, or as approved.
- B. Sizes, materials, types and finishes shall be as noted in the schedules or elsewhere on the drawings. Substitute louvers shall not have less free area than the specified units.
- C. All louvers furnished for mounting in masonry wall construction shall be furnished with an extended or separate sill.
- D. Unless indicated otherwise, all louvers for masonry walls will be box frame without face flange.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install all ductwork and fittings generally in accord with the applicable SMACNA Manual or ASHRAE Guide. Adequately support with sheet metal strap, strap irons or rods as required, fastened securely to the duct and to building construction.
- B. Joints shall be mechanically secure and airtight.
 - 1. Joints, seams and other possible leakage areas shall be sealed with sealants specified above. It is the intent to have no air leakage out of the duct system.
- C. Turning vanes shall be installed at all 90 degree elbows and elsewhere as indicated. Set in tight with the back vane tangent to the sides of the duct.
- D. Connections to equipment shall be made with flexible connections with at least 4" metal-to-metal unless otherwise noted on drawings. Flexible connections shall be airtight.
- E. All dampers shall operate smoothly through their entire range. Provide locking mechanisms to secure volume dampers in position.
- F. Flexible ducts shall be connected to duct collars with nylon or stainless steel drawbands. If necessary for tightness, use mastic in addition to drawbands. Flexible duct connections shall be arranged on the main duct in such manner to provide the most direct and streamlined approach

to diffusers or terminal units. Avoid sharp and unnecessary bends. Use sheet metal elbows for all 90 degree (or greater) bends less than four feet in bend radius. Avoid runs of flexible duct over 4' long unless otherwise indicated on the drawings. Flexible duct to be supported as recommended by SMACNA.

G. Wall and Floor Penetrations

1. Provide sheet metal sleeves in all concrete or masonry walls and floors. Frame or sleeve openings through stud walls.
2. Sleeves and openings sized to accept the duct with insulation. Pack insulation in after duct is installed.
3. Grout sleeves in place in existing masonry walls or floors.
4. Provide finishing collars on each side of wall or floors at all penetrations.
5. Seal the space between ductwork and sleeves with mildew resistant silicone caulk.

H. Access Doors

1. Install access doors in the locations listed below, at all locations shown on the plans, and elsewhere as necessary for damper or service access or observation. Final locations and sizes of doors shall provide maximum access for service of the component being accessed.
 - a. At splitter dampers (use 8" X 8" door).
 - b. At volume dampers (use 8" X 8" door).
 - c. At fire dampers (use largest standard square size duct will accept).
 - d. At motorized dampers (use largest standard square size duct will accept or multiple 12" X 12" size to provide service access to the entire damper).
 - e. At duct coils (use largest standard square size duct will accept or multiple 12" X 12" size to provide service access to the entire coil. Access shall be provided at both sides of the coil to facilitate cleaning of coil).
 - f. Immediately downstream of all duct-mounted humidifiers on both sides of the duct.

I. Grilles, Registers, Diffusers

1. Set flush, level and plumb, tight to floor, wall or duct. Use gaskets or plaster frames on all grilles and registers for sealing against floors, walls, ceilings or exposed duct.
2. Furnish special keys to Owner's representative for operating the different types of dampers.
3. Provide adjustable air volume extractors with all registers set into the sides of ducts.
4. All dampers and mechanisms to operate smoothly.
5. All diffusers which are mounted on exposed duct systems shall be mounted on neck ducts or saddle taps with turned-in flanges which have the same exterior size as the diffuser frame.

6. Diffusers/Grilles which are mounted to wall or ceiling surfaces and are not supported by duct systems shall be secured through the ceiling or wall to a suitable frame on the opposite (back) of the mounting surface.
7. Paint the ductwork visible through the face of grilles and diffusers flat black.

End of Section

SECTION 233400 - FANS

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide ceiling and roof mounted exhaust fans.
 - 1. Centrifugal Fans:
 - a. Domed roof, up blast roof and sidewall exhaust fans.
 - b. Ceiling fans.

1.2 SUBMITTALS

- A. Submit the following product data for each unit:
 - 1. Static pressure, airflow (CFM), speed (RPM), system curve, outlet velocity and fan tag for each fan.
 - 2. Certified fan curves showing fan performance with the system operating points identified on curves. Surge, or "Do not operate" line, shall also be indicated on fan curve.
 - 3. Performance curves shall be published by the fan manufacturer and based on tests in accordance with AMCA 210. The curves shall be drawn with the fan flow rate plotted against fan total pressure and fan brake horsepower as per section 10.2.1 of AMCA 210.
 - 4. Sound power levels for each size and type of fan. Sound levels shall be provided for all 8 octave bands for discharge of fan, inlet to fan, and radiated noise through casing.
 - 5. Dimensional data for each size and type of fan, including operating and maintenance clearances.
 - 6. Details of vibration isolation bases including selections for vibration isolation springs.

1.3 WARRANTY

- A. Provide a complete parts and labor warranty for a minimum of one year from the date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers and Products: The products and manufacturers as indicated in the fan schedules establish the standard of quality for the Work. Equivalent products of the specified equipment is approved.

PART 3 - INSTALLATION

3.1 FAN INSTALLATION

- A. Coordinate the fan arrangement with project conditions prior to ordering the fan.
- B. Receive and inspect fans for defects. All defective or damaged fans shall be replaced at no cost to the Owner.

- C. Openings shall remain protected during storage. Immediately after installation and assembly, all factory protection shall be restored. Unit shall remain protected until just prior to final acceptance by Owner.
- D. Fans shall be installed as shown on drawings, in accordance with details, approved submittals and the fan Manufacturer's installation requirements and recommendations. Ensure fans are installed to allow easy accessibility for service or removal of fan components.
- E. Provide and install supplemental steel, supports, isolators and hangers necessary to hang or mount fans. Coordinate final location and placement of intermediate steel and ductwork connections in field. Install suspended fans with supports attached to structural members.
- F. Install any associated motors, drives, or other components that have been shipped loose. Fan shall be installed, made fully operation, and tested.
- G. Install flexible inlet and discharge couplings to prevent vibration transmission to ductwork.
- H. Inlet and discharge ductwork shall have a minimum straight run of two (2) fan diameters upstream and downstream of the fan.
- I. Just prior to final acceptance fan shall be thoroughly cleaned of all grease, dirt, and dust, etc. Apply touch-up paint or touch-up coating after final cleaning to repair any damage to the finish.
- J. Provide or coordinate the scope of work associated with the installation of fans as specified in the following sections:
 - 1. Roof curbs
 - 2. Concrete Housekeeping Pads
 - 3. Vibration isolation
 - 4. Sheet Metal accessories
 - 5. Interconnection wiring and conduit from power source to fan connection (starter).

3.2 FIELD QUALITY CONTROL

- A. Each fan shall be field tested. Any deficiencies related to performance, manufacture or installation shall be corrected without cost to Owner.

END OF SECTION 233400

SECTION 235415 - GAS-FIRED MAKE-UP AIR UNITS

PART 1 GENERAL

1.1 WORK INCLUDED

- A. This Section governs the materials and installation of gas-fired heating units such as unit heaters and make-up air units.

1.2 EQUIPMENT SUBSTITUTION

- A. Where equipment may be described by manufacturer, name, or model, such description shall establish a standard of quality, size and arrangement.

1.3 TESTING & APPROVING AGENCIES

- A. Where items of equipment are required to be provided with compliance to U.L., A.G.A., or other testing and approving agencies, the Contractor may submit a written certification from any nationally recognized testing agency, adequately equipped and competent to perform such services, that the item of equipment has been tested and conforms to the same method of test as the listed agency would conduct.

1.4 SUBMITTAL DATA

- A. Provide manufacturer's literature for all products specified in this Section which will be installed under this project.
- B. The unit manufacturer shall prepare a complete wiring diagram showing connections, color coding, low voltage and line voltage wiring to all components. This drawing shall be on one sheet (it shall not be pieces of standard drawings, each concerned only with the one piece of equipment). The drawing shall be for this specific job, with specified thermostat shown and specific starters and relays, where used, shown. This drawing shall be submitted with equipment literature and shall be corrected and resubmitted until approved by the Engineer.

PART 2 PRODUCTS

2.1 MAKEUP AIR UNIT (INDIRECT GAS FIRED)

- A. Products manufactured by Hastings, Reznor and Sterling are approved as equal in quality to that specified, providing they can meet the features of the specified unit.
- A. General: Self-contained, factory assembled and tested, roof-mounted make-up air unit to supply, filter and temper 100% outdoor air. Unit shall be A.G.A. certified and conform to ANSI Standards for Safe and Efficient Operation. Fan capacity, heating capacity, unit arrangement, electrical characteristics, and other special features shall be as indicated on the drawings. Unit(s) shall be completely factory assembled, tested, internally wired, fully charged with Refrigerant R410A, and shipped in one piece. Unit(s) shall consist of insulated weather-tight casing with field installed outdoor intake hood, modulated capacity scroll compressors, air-cooled condenser coils, condenser fans, evaporator coils, supply fan, motors and drives, and unit controls.
- B. Casing: Outer casing is fabricated from G90 galvanized steel substrate with 60 gloss painted finish coat. Roof panels shall be 20 gauge with double-wall 2" insulation liner. Fully-gasketed, hinged doors of double-wall construction shall provide access to filters, dampers, evaporator coils section, supply fan section. Provide hinged single wall construction doors for the heater section and control section. On hinged doors frequently used for service (i.e. filter and coil access) lift and turn style door handles that do not require the use of a tool to gain access will be used. The unit control panel

section shall be laid out to provide separation of high and low voltage components per L standards. The control panels shall be hinged for easy access to the unit controls. For ease of service, all electrical components will be clearly identified with 1/2" diameter self adhesive labels to match the unit specific wiring diagram. The low voltage and unit controller access electrical panel shall be physically isolated from the high voltage section. The open door to the control section will reveal the wiring diagrams, DDC programming instructions and all manuals and literature protected and permanently attached to the cover. All control transformers will incorporate integral, resettable circuit breaker protection. A weatherproof convenience outlet will be accessible from the outside of the unit without the removal of any doors or access panels.

- C. Air Side: The outdoor condenser fan shall be direct drive, statically and dynamically balanced, draw through in the vertical position. The condenser fan motor(s) shall be permanently lubricated and have built-in thermal overload protection. The centrifugal supply fan(s) shall be double-width, double-inlet fan with forward-curved blades mounted with adjustable pitch sheave drive assembly. Complete fan assemblies shall be statically and dynamically balanced in accordance with the latest ARI guideline and ANSI 2.19. Ball Bearings with a minimum L10 life of 100,000 hours shall be available from the manufacturer. The centrifugal supply fan(s) shall be available with bearings, drive, and motor combinations for high static applications. All fan motors shall be thermally protected. Motor shall be continuous duty, thermally protected, permanently lubricated, ball bearing with a 1.15 service factor. Electrical characteristics and enclosure per schedule. Drives are to be selected for 125% of driven horsepower. Blower pulleys shall be cast iron, variable speed. The fan system shall be fully vibration isolated using springs and flexible connectors. The fan system shall be statically and dynamically balanced in accordance with the latest ARI guideline and ANSI 2.19. The unit shall provide vertical discharge. 100% outdoor air intake hood with bird screen and motorized intake shut-off damper. The damper shall close whenever the fan is off.
- D. Refrigeration System: Compressor systems shall be designed to provide 10 - 100% capacity control for treatment of up to 100% outside air with up to 80 degree dewpoint entering the unit. Hermetic compressors shall include a scroll design with internal pressure relief and motor temperature winding protection. Units shall be equipped with reversal rotation protection. Refrigeration protection shall include low and high pressure switches, refrigerant circuit frost protection, liquid line filters/dryers and service gage ports. Refrigeration control shall include thermal expansion valves, external equalizers and distributors for each compressor. Hot gas bypass options shall be available on all refrigerant stages in addition to multiple steps of capacity modulation to supplement discharge air control. The refrigerant system shall have an adjustable 5 minute minimum ON and minimum OFF timer circuit protection. The refrigerant circuit shall have an anti-cycle time in addition to the minimum ON/OFF timer that prevents the compressors from cycle on the minimum timer circuit. The refrigerant system shall include a horizontal discharge air cooled condenser. The copper tube-aluminum plate fin evaporator coil to be 4 rows with 15 fins per inch to meet SHR values of 0.60 - 0.70. All multi-circuit evaporator coils are of the interlaced and split face configuration to reduce the risk of coil freezing at part load. All evaporator coils shall be protected from frosting by a low temperature cutout. All Coils shall be leak tested at the factory to ensure pressure integrity. The condenser coils shall be aluminum micro-channel type condensing coil [A coil guard will be included for protecting the condensing section.] Units will ship completely charged for immediate operation upon installation and check-out of the unit.
- E. Condensate Drain Pan: The condensate drain pan shall be fabricated from stainless steel. The drain outlet shall be attached to a sloped drain pan with a minimum 1/8" per foot slope. The sloped drain pan shall be of a removable design. The drain pan shall collect potential condensate from all evaporator/condenser coils and distributor area in the air stream to prevent blow-off condensate reaching unprotected bottom unit surfaces.
- F. Operating Controls: Controls shall be factory configured for the design application with both the required hardware, operating parameters, and typical default control setpoints. The controller is factory mounted on the unit and is pre-wired to the unit controls. The controller shall have visual (LED) status of power, running, and errors. LED indicators for transmit/receive for networks and for

each of the 12 outputs. The unit shall have battery backup to maintain control program and data for a minimum of 10,000 hours during power outages. The controller shall have unit mounted display with two line 40 alpha/numeric character per line display providing full access to all commission variables, setpoints, alarms and diagnostic functions. The controller shall have BACnet (ARC156, MS/TP, and PTP) network communication available without the need for further programming or external devices. Customer wall-mounted controls shall be provided (locate in mech room on 1st floor) for providing [remote temperature adjustment] [on/off -auto control] [damper adjustment]. Each unit shall be equipped with an air-proving switch to ensure proper blower operation prior to enabling cooling and heating functions. Cooling controls shall include minimum "on/off" compressor time delays and anti-cycling program to prevent unnecessary wear of compressor. Commissioning control variables shall include outdoor setpoints for heating and cooling sequencing based on outdoor [drybulb] [dewpoint], discharge temperature setpoints and low limit discharge air settings for freeze protection. The alarm functionality shall include low temperature, compressor failure, sensor failure, smoke alarm, power failure, heating failure and supply fan failure. The failures shall protect the unit and displays a code at the unit's display and the wall mounted display. The unit will have test and diagnostics routines for services and start-up. The control system shall be able to provide neutral air and space temperature control per the sequence of operation shown.

- G. Filters: 2" disposable extended surface pleated filters rated Merv 8.
- H. Heating: Heating shall be provided by a gas-fired heating section designed to provide a 16:1 power vented modulation with a minimum 80% thermal efficiency throughout the modulated range. The system shall modulate the gas and combustion air to maintain temperature setpoint and thermal efficiency. The heat exchanger shall be capable of 100 degree temperature rise for 100% outside air treatment. The heating system shall be factory installed and design certified to ANSI Standard Z83.8/CSA 2.6. The heat exchanger shall be 4 pass serpentine, non welded, constructed of 409 stainless steel. The gas burner shall be direct spark, multi-try, with a flame sensing circuit monitored by an electronic flame supervision system with 100% lockout via an integrated circuit board that incorporates LED diagnostics. Diagnostic codes shall include [failed ignition] [primary limit failure] [value failure] [air sensor] [gas sensor] [flame sensor].
 - 1. **Certifications:** The gas heat sections shall be and approved to ANSI Z83.8/CSA 2.6.
 - 2. **The packaged unit shall be certified to** UL-1995 – UL Standards for Safety Heating & Cooling Equipment Second Edition: CAN/CSA C22.2 NO. 236-95.
 - 3. **Safety Features:** All heat sections for said unit shall feature factory installed:
 - a. Automatic **discharge air** limit Control
 - b. **Air proving pressure switch**
 - c. Color coded wiring and matching terminal blocks
 - d. Circuit breaker protected transformers.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install all units as noted and shown on the drawings and in strict accord with the manufacturer's instructions, printed and verbal.
- B. Units shall be completely serviced before final acceptance. This includes lubrication, belt adjustment, installation of clean filters, adjustment of controls, etc.
- C. Cooperate with other trades to ensure the proper construction and location of the correct size plenum, pads, supports, and openings in construction to accommodate the equipment used.
- D. Flue and Smokepipe
 - 1. Install in strict accord with NFPA, in particular with regard to clearance from combustible

materials.

- E. Units shall be fitted with clean filters at the time of project acceptance.

3.2 TESTING, BALANCING, CHECKING

A. Testing

1. Units shall be observed during normal system operation after all balancing is complete. Any excessive noise indicating loose belts, bad bearings, etc., shall be corrected.
2. Test all gas and safety controls as per the manufacturer's printed instructions.

B. Balancing

1. Unit balancing shall be accomplished in conjunction with air distribution system balancing. See SECTION 230593
2. Units shall be adjusted to the specified airflow by adjusting pulleys and drives to achieve specified cfm. If necessary, the Contractor shall change the fan sheaves to adjust units to the required rpm.

End of Section

SECTION 236000 - REFRIGERATION SYSTEMS

PART 1 GENERAL

1.1 QUALITY ASSURANCE

- A. Materials, methods, workmanship and testing shall be in accord with the applicable sections of the ASHRAE Handbook and good industry practices.

1.2 CODE REQUIREMENTS

- A. The applicable requirements of the International Code (IMC) shall be adhered to. The requirements are those directed at mechanical refrigerating equipment, equipment rooms, system piping and components.

1.3 SUBMITTAL DATA

- A. See SECTION 15000 for general submittal data.
- B. Shop Drawings
 - 1. Manufacturer's Data
 - a. Submit complete manufacturer's data on condensing unit and on all components in the refrigeration piping circuit.
- C. Reports
 - 1. Submit start-up and test report.

PART 2 PRODUCTS

2.1 AIR-COOLED CONDENSING UNITS

- A. Units to be complete in every respect, capacity matched to the A.C. unit.
 - 1. Structural galvanized steel cabinet with slab type seamless copper tube/aluminum fin coils.
 - 2. Vertical discharge direct-drive fans. Motors with permanent lubricated ball bearings. Built-in current and thermal overload protection.
 - 3. Provide motor starters or contactors, controls transformer (if required), terminal block for compressor interlock, and factory wiring. Each ungrounded leg to motors protected. Provide phase failure relay on all three phase equipment.
 - 4. Provide low ambient operating controls as follows:
 - a. As noted in schedule or down to 30F.
 - 5. Provide spring type vibration isolators, sized for the unit weight.
 - 6. Provide wire coil guards to protect fins from damage from external forces (hailstone, etc.)

2.2 REFRIGERATION PIPE AND FITTINGS

- A. Type L brightly annealed and sealed copper tubing factory prepared for refrigeration use. Tubing to be sized by manufacturer in accordance with manufacturers written guidelines. (Refrigeration line sets may be used at contractor option)
- B. Refrigerant tubing sealed at factory to keep out dirt and moisture, and to remain sealed until installed.
- C. Fittings wrought copper. Suitable for use with high temperature silver solder. Use both long and short radius elbows as required.
- D. Solder to be high temperature silver solder such as Sil-Fos or Easy-Flo with a melting point of at least 1000 degrees F.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Condensing Unit
 - 1. Mount condensing units as indicated, and pipe up complete and operating. Mount unit level and on vibration isolators.
 - 2. Condensing unit serviced such as lubrication of motors, coupling alignments, wiring checkout, etc., before starting unit.
 - 3. Install per manufacturers instructions complete for a fully operational system.
- B. Piping
 - 1. Pipe assembly shall be done by qualified, experienced refrigeration mechanic in accord with procedures and methods set forth in the ASHRAE Handbook.
 - 2. Remove dirt, slag and foreign materials from piping by swabbing out with a lintless cloth.
 - 3. An inert gas shall be flowing through piping during soldering.
 - 4. Use vibration eliminators for making connection to equipment.
 - 5. Install all piping per manufacturers written instructions complete with the components listed.
- C. Components
 - 1. Install manual valves as required for proper servicing of the system. Locate for easy operation.
 - 2. Moisture-liquid indicator: Installed in liquid line downstream of each solenoid refrigerant valve.
 - 3. Refrigerant drier: Installed in liquid line as indicated. Locate in position for easy removal of cartridges.
 - 4. Solenoid valves: Install in liquid line to each DX coil with head in vertical position. Locate for easy access to manual lift device.
 - 5. Expansion valves: Install in liquid line to each DX coil with head in vertical position. Remote

bulb clamped on horizontal suction at 45 degrees below horizontal. Equalize line connected into suction line downstream of remote bulb.

6. Pipe all relief valves to the outside of the building. Pipe to be same size as valve discharge, unless otherwise noted.

3.2 INSTRUCTION

- A. Full instructions covering the operation, maintenance, function, service requirements, etc., will be given to the Owner's representative by the unit manufacturer's representative after the system is operating and approved by the Engineer.

End of Section

SECTION 237510 - PACKAGED HEATING/COOLING UNITS

PART 1 GENERAL

1.1 TYPE OF UNITS

- A. This Section governs the materials and installation of self-contained units such as room air conditioners.

1.2 SUBMITTAL DATA

- A. See Section 15000 for general submittal requirements.
- B. Provide manufacturer's literature for all products specified in this Section which will be installed under this project.
- C. Provide specific fan performance and heating/cooling capacities for all units. Fan performance data shall account for all filters, coils and internal unit losses in addition to the external static pressure. Fan and heating/cooling data shall be corrected for the datum elevation of the project.
- D. Submittal data shall include wiring diagrams specific to each unit to be furnished. Diagrams shall indicate and differentiate between factory and field wiring.

PART 2 PRODUCTS

2.1 SCHEDULES

- A. Refer to the drawing for schedules and specifications listing specific units, types, capacities and special features.
- B. Units shall be furnished complete with all accessories required for proper operation.

2.2 PACKAGED TERMINAL AIR CONDITIONING UNITS

- A. Description: Packaged, self-contained, through-the-wall terminal units with room cabinet, electric refrigeration system, heating, and temperature controls; fully charged with refrigerant (R-410a).
 - 1. Cabinet: Provide removable front panel with concealed latches.
 - a. Mounting: Wall with wall sleeve.
 - b. Finish: Manufacturer's standard color.
 - c. Control Knobs: Shall be secured so that they can not be easily removed (anti-theft knobs).
 - d. Discharge Grille and Access Door: Provide discharge grille with hinged door in top of cabinet for easy access to controls.
 - e. Subbase: Enameled steel with adjustable leveling feet and adjustable end plates.
 - f. Wall Sleeves: Insulated High strength polycarbonate or polymer construction. Universal drain kit piped to concealed vertical condensate drain.
 - g. Louvers: Architectural louver, color selected by architect.

2. Refrigeration System: Direct-expansion indoor coil with capillary restrictor, hermetically sealed compressor with internal spring isolation, external isolation, permanent-split-capacitor motor, and overload protection. Include the following:
 - a. Outdoor coil and fan.
 - b. Accumulator
 - c. Reversing valve for heat pump operation.
3. Preventative Maintenance: Split outdoor fan shroud for easy access to outdoor coil for cleaning and maintenance.
4. Air System: Forward or backward curved, centrifugal, indoor fans with two speed TEFC permanently lubricated permanent-split-capacitor motor, permanent one or two-piece interchangeable polyurethane washable filters, return air indoor filters and outdoor vent filter with concealed operation located under the front panel to manually open and close the outdoor vent.
 - a. Curtain Deflector: Manufacturers standard curtain deflector to insure the curtains will not blow into the discharge air stream.
5. Electric-Resistance Heating Coil: Nickel-chromium wire, electric-resistance heating elements with contactor and high-temperature-limit switch. Use coiled or sheathed heating elements (non-glowing). Provide thermal safety and overheat limit control and 2-stage heating for coils 3.5 kw and larger.
6. Condensate Drain: Condensate drain kits for connection to piped condensate drain system to a code approved location.
7. Outdoor Fan: Propeller type with corrosion resistant finish.
8. Coils: Aluminum plate fins mechanically bonded to seamless copper tubes with all joints brazed.
9. Electrical Requirements: See schedule for information. Supply pre-wired [UL](#) approved for hard-wired connection. Connection must be concealed in sub-base.
10. Provide manufacturers acoustical reduction insulation blankets/liner for quiet operation.

B. CONTROLS

1. GUEST SUITE THERMOSTAT

- A. Remote, wall-mounted, electronic digital thermostat specifically designed for guest suite applications must be provided.
- B. Required features are as follows:
 - 1) System on/off selection
 - 2) Automatic or manual heating/cooling selection
 - 3) Backlit led/lcd digital display with temperature numerals that are at least 0.5"/12.0 mm in height.
 - 4) Fan mode button that allows guest to have either continuous fan, fan cycling on demand of heating/cooling, and manual speed selection.
 - 5) Control algorithm that causes fan speed to increase as the room conditions increase above set point, returning to low speed as set point is reached.
 - 6) Concealed temperature limits for heating and cooling.
- C. Locate thermostats remotely from the air conditioning device, typically near the bathroom and entry wall in a location unaffected by supply air drafts.

C. SOURCE QUALITY CONTROL

- 1. Sound-Power Level Ratings: Factory test to comply with [ARI](#) 270, "Sound Rating of Outdoor Unitary Equipment."
- 2. Unit Performance Ratings: Factory test to comply with [ARI](#) 310/380, "Packaged Terminal Air-Conditioners and Heat Pumps."

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install units as noted and shown on drawings in strict accord with manufacturer's recommendations.
- B. Units to be checked out, lubricated, fan wheels balanced, belts and drives adjusted before being placed into service.

3.2 TESTING, BALANCING, CLEANING

- A. This Contractor to furnish all labor and materials for testing.
- B. Testing
 - 1. Units to be tested in normal system operation after all balancing is complete. Any excessive noise indicating loose belts, bad bearings, etc., to be corrected.
- C. Cleaning
 - 1. Clean all equipment inside and out.
 - 2. Provide units with clean filters at time of final acceptance.

End of Section

SECTION 238220 - FAN COIL UNITS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fan-coil units with direct drive fans, and hydronic/electric/DX coils. Controls provided in part or in entirety by the fan coil manufacturer, as specified.

1.2 COORDINATION

- A. Coordinate dimensions and arrangement of fan coils with building elements including to maintain all maintenance clearances. Pay special attention to required electrical clearance.

1.3 SUBMITTALS

- A. Submit the following product data for approval:
 - 1. Heating and cooling coil total and sensible heat transfer capacity, entering and leaving water temperatures, flow rates and air pressure drop.
 - 2. Piping connections including size, material types, and dimensioned locations for each service.
 - 3. Ductwork connections including sizes, locations, and methods of connections to mating ductwork.
 - 4. Locations of electric power connections.
 - 5. Details of equipment assemblies indicating dimensions, weights, required clearances, component locations, and location and size of each field connection. Include cabinet construction details: panel gauge, removal method for access panel, cabinet mounting method, and filter and fan motor removal method.
 - 6. Details of motor including type, manufacturer and electrical characteristics.
 - 7. Octave band and A-weighted sound power data for each unit type at fan coil rated capacity, tested per AHRI Standard 350.
 - 8. Evidence of UL or ETL listing and labeling.
- B. Equipment schedule with the following information for each unit type:
 - 1. Equipment tag.
 - 2. Room number of thermostat location.
 - 3. Model number.
 - 4. Manufacturer's size designation.
 - 5. Number of coils, number of rows for each coil, fin spacing for each coil.
 - 6. Electric heating element electrical info.
 - 7. Heating and cooling capacity.
 - 8. Airflow rate and motor watts at each fan speed.
- C. Maintenance schedules and repair part numbers and manufacturer of motors, coils, integral controls, relay board, control transformer, and air filters.

1.4 WARRANTY

- A. Provide a complete parts and labor warranty for a minimum of one year from the date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers:
 - 1. Enviro-Tec or equal.
 - 2. Substitutions shall be no larger in dimensions than unit specified.

2.2 FAN COIL UNIT CONSTRUCTION

- A. Dimensions: Maximum allowable dimensions as indicated on the Drawings.
- B. Casing Construction:
 - 1. Construction: Minimum 18 gauge, G60 galvanized or A40 galvanized steel or as scheduled. Construct to eliminate racking.
 - 2. Access panels shall be fully insulated and attached with fasteners on at least two opposite sides. No coil or drain piping or electrical connections shall pass through any access panel.
 - 3. One inch duct collars if connected to ductwork.
- C. Insulation: Exterior panels and access panels: Foil faced minimum 1-inch-thick, 1-1/2 lb density fiberglass fire resistant insulation complying with the following:
 - 1. ASTM C 411 Standard Test.
 - 2. Attach with adhesive complying with ASTM C 916.
 - 3. Fire-Hazard classification, insulation and adhesive combined: Maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E 84.
 - 4. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

2.3 COILS

- A. Electric/DX
 - 1. Equal or greater than unit specified.

2.4 DRAIN PANS

- A. Condensate Drain Pan: Fabricate drain pans and drain connections to comply with ASHRAE 62.1.
 - 1. Drain pan: Stainless steel, insulated.
 - a. Located under cooling coil allowing the drain pan to be fully inspected and cleaned.
 - b. Slope to drain completely dry upon fan coil shutdown.
 - 2. Overflow drain pan connection: shall be on the same side and at a higher elevation than the primary drain pan connection.
 - 3. Water-level detection device conforming to UL 508, factory wired to shut off the equipment prior to drain pan overflow.

2.5 FILTERS

- A. Minimum arrestance according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2

1. Disposable Type: 2-inch pleated cotton-polyester media: 90 percent arrestance and a MERV A rating of 8.

2.6 FAN AND MOTOR:

- A. Fan: Forward curved, double width, centrifugal, direct drive fan(s) mounted on removable fan deck or with easily removable fan and motor. Galvanized steel or aluminum wheels; galvanized-steel fan scrolls.
- B. Motor Wiring: Terminate wiring in a junction box, external to the unit casing for a single point connection.
- C. Provide a project specific wiring diagram affixed to the inside of each fan coil cabinet.
- D. Motor: In compliance with Related Section "Motors", permanent split capacitor (PSC) type, 3 speed/3 tap, sleeve bearings.
- E. Motor: In compliance with Related Section "Motors", electronically commutated motor (ECM). Designed for use with a single phase electrical input. Motor to be complete with and operated by a single phase integrated speed controller/inverter, speed adjustable manually or via external 0-10 VDC signal, built-in soft start/speed ramps, with permanently lubricated ball bearings.

2.7 SOURCE QUALITY CONTROL

- A. Factory test all coils with a minimum of 350 psig air pressure while submerged under water.
- B. Assemble and factory test each unit prior to shipping. Pressure test coils and piping packages for leaks. Cycle controls and operate fan at all speeds to check for proper operation. Correct all deficiencies prior to shipping.

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION

- A. Examine areas to receive fan-coil units for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine rough-in construction for piping and electrical connections to verify actual locations before fan-coil-unit installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install fan coil units level and plumb and to comply with Quality Assurance Standards and manufacturer's installation instructions.

3.3 CONNECTIONS

- A. General piping installation requirements are specified in Related Documents Specification Sections. Drawings indicate general arrangement of piping, fittings, and specialties. Connect hydronic, condensate drain, and overflow drain piping to the unit.

3.4 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:

1. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.
2. Test unit operation with thermostat in all modes of operation.
3. Verify that drain pans collect all condensate and are properly sloped to drain so that no condensate is retained in the pans.
4. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 238220

DIVISION 26 – ELECTRICAL

SECTION 260000 - GENERAL PROVISIONS FOR ELECTRICAL WORK

PART 1 GENERAL

1.1 BIDDING

- A. The Contractor shall provide labor, materials, equipment, items, articles, operations and methods listed, shown, scheduled, or mentioned on the drawings, and/or specified, including all incidentals required for their completion.
- B. The Contractor shall refer to the General part of these specifications, such as Instructions to Bidders, Special Conditions and DIVISION 1.
- C. These drawings and specifications are intended to show the minimum requirements of construction as required for permitting of the project. The contractor shall provide all additional electrical labor, equipment and materials for fully complete and operational systems meeting all codes and governing regulations.

1.3 SUBSTITUTIONS

- A. Most items in this DIVISION are eligible for substitution in accordance with the General Conditions and Supplements hereto.
- B. It is the Contractor's responsibility that the substitute item shall fit into the space allocated and that the item can be installed and function as intended. Should changes in the work of any Contractor become necessary as a result of any substitute item under this DIVISION, such changes shall be arranged and paid for by this Contractor.
- C. Capacities of substitute items shall not be less than that of the specified item.

1.4 CODES, REGULATIONS AND PERMITS

- A. All materials and equipment shall be new, approved by Underwriters' Laboratories, Inc., or by the local inspection authority, and be in new, undamaged condition when installed.
- B. Comply with the current adopted codes and regulations including the National Electrical Code, National Electrical Safety Code, International Building Code, and all other applicable Federal, State, City and County codes, regulations and ordinances.
- C. Obtain and arrange for all permits and approvals required for the execution of the work.

1.5 INTENT OF DRAWINGS

- A. Riser diagrams and other diagrams are schematic only and not to scale. They are

intended only to indicate sizes or relative arrangement of conduit and equipment shown elsewhere in plan view.

- B. Plan view drawings are intended to general locations of equipment and conductors. Contractor must coordinate with other trades to determine final locations. Notify engineer of any conflicts and discrepancies prior to commencement of work.

1.6 WORKMANSHIP

- A. Work to be accomplished by workmen skilled in the particular trade, in conformance with best practices and to meet all applicable codes.
- B. The Engineer decides where work is satisfactory. This Contractor shall replace materials or equipment not properly installed or finished, without increase in payment received.

1.7 RESPONSIBILITY

- A. The Contractor is responsible for installation of satisfactory and complete piece of work in accordance with true intent of drawings and specifications.
- B. Consult all drawings for project to predetermine that work and equipment will fit as planned.
- C. Location of conduit, panels, outlets, equipment, switches, etc., checked to determine it clears openings, structural members, cabinets, heating units, ducts, piping and equipment having fixed locations. This shall be accomplished prior to rough-in.
- D. If, at any time, and in case, change in location of conduit, outlets, fixtures, switches, panels, equipment, etc., become necessary due to obstacles or installation of other trades shown on any of the project drawings, such required changes made by Contractor at no extra cost. These changes shall be recorded on the project drawings.

1.8 DELIVERY AND STORAGE OF MATERIALS

- A. Make provisions which are acceptable to the Owner and Engineer for delivery and storage of materials.
- B. Make provisions for introduction into the building of equipment furnished under this DIVISION.
- C. Refer to DIVISION 1 for additional provisions to allow equipment passage into the building.

1.9 MANUFACTURER'S DIRECTIONS

- A. Manufactured materials and equipment applied, installed, connected, erected, used, cleaned and conditioned as directed by manufacturer unless noted otherwise herein

or on the drawings.

1.10 CUTTING, PATCHING, REPAIRING

- A. Cutting, patching and repairing required by the work of this DIVISION shall be the responsibility of this Contractor.
- B. Work shall be performed in accordance with DIVISION 1 of these specifications.
- C. The performance of this work shall not weaken the structural integrity of the building.
- D. Any abrasion or disfigurement of the finished work or any portion of the building where any such abrasion or disfigurement is caused by the activities of the Contractor shall be repaired, and neatly refinished to match the adjacent work.

1.11 OPENINGS IN RACEWAYS AND BOXES

- A. Openings in conduit, boxes, etc., shall be kept closed during progress of work.
- B. The Contractor required to clean new systems found dirty to satisfaction of Engineer at no additional cost.

1.12 CLEANUP

- A. Upon completion of work, remove materials, scraps, etc., relative to this work and leave premises in clean and orderly condition. This applies equally to finished, unfinished and concealed spaces.
- B. Clean equipment of dirt and debris, including interior of panels, outlet boxes, lighting fixtures, and fixture lenses.

1.13 SAMPLES

- A. The Contractor shall submit actual production samples on any material or equipment requested if, in the Engineer's opinion, it is necessary in order to determine the quality, workmanship, operation, etc. of the item. Samples may include lighting fixtures.
- B. Samples will be returned to the Contractor. Approved samples may be used on the job.
- C. Costs incurred in providing and returning samples will be the responsibility of the Contractor.

1.14 TEMPORARY SERVICES

- A. See DIVISION 1 - GENERAL REQUIREMENTS for Temporary Facilities.

1.15 FIRE PROTECTION

- A. Pipe penetrations of all fire partitions, walls and floors shall be effectively fire-stopped using materials and methods UL approved for this purpose. One such material is Carborundum bulk "Fiberfrax" fiber packing for filling the annular space between pipe and sleeve packing and Fiberfrax LDS moldable caulking for sealing in the fiber packing. Another acceptable material is Dow Corning 3-6548 Silicon RTV foam firestop system.

1.16 EQUIPMENT MOUNTING

A. Floor Mounting

1. Concrete bases 4" high with chamfered edges shall be provided under floor-mounted equipment such as switchboards, transformers, and motor control centers where bases are called out or indicated on the drawings.
2. Floor-mounted equipment shall be secured to the concrete bases with steel anchor bolts preset in the concrete base. Anchor bolts and anchoring shall be capable of resisting horizontal and vertical earthquake forces as required in the Uniform Building Code, Section 2312. Where spring-type vibration mounts are required, they shall be secured to the concrete bases and, in addition, the equipment restrained whereby the equipment is free to vibrate but cannot move from the base.

B. Wall Mounting

1. Wall-mounted equipment, such as panelboards, shall be securely fastened to the wall using appropriate fasteners such as toggle bolts, expansion bolts, etc.

1.17 COMPLETION AND TESTS

- A. Complete and test each system and leave in proper operation. Leave all systems in proper operation.

1.18 OPERATING INSTRUCTIONS

- A. Owners training; The Contractor shall provide qualified personnel to instruct the Owner's maintenance people in the operation and maintenance of the system. At the completion of the project an owners training/systems demonstration walkthrough shall be scheduled with the owners maintenance personnel.
- B. All operation and maintenance instructions, as produced by the manufacturer, shall be provided for all equipment. These instructions shall be provided in pdf electronic format. Submit 2 copies of required information on a compact disk or other approved format.

PART 2 SUBMITTALS AND BROCHURES OF EQUIPMENT

2.1 GENERAL

- A. Provide submittal and shop drawing information on all equipment to be installed. Materials submittals are not required.
- B. Submittals shall be delivered in electronic format such as PDF.
- C. At the completion of the project, all approved submittals and operation and maintenance information shall be included in the equipment brochures in pdf electronic format to be delivered to the owner.
- D. All information shall be indexed by specification section and marked appropriately.

END OF SECTION 260000

SECTION 260519 - CONDUCTORS

PART 1 GENERAL

1.1 QUALITY ASSURANCE

- A. Conductors shall be of American manufacture and made in accordance with the requirements of the National Electrical Code and the Underwriters Laboratories.
- B. Conductors shall be copper or Aluminum as noted.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Type THW or THWN conductors shall be used in wet or dry locations unless otherwise indicated on the drawings. Type THHN may be used in dry locations.
- B. Connectors
 - 1. Cable size #6 or larger, use lugs or approved connectors.
 - 2. Conductors #8 and smaller, use one of the following solderless connections or approved equal:
 - Ideal Industries "Wing Nut"
 - 3M Co. "Scotchlok"
 - Buchanan steel splice cap with nylon insulator
- C. Note any special wiring of auxiliary systems as specified elsewhere or noted on the drawings.

PART 3 EXECUTION

3.1 INSTALLATION

- A. All conductors installed in raceways.
- B. Conductors to be sized in accord with the National Electrical Code except minimum size #12 AWG gauge unless otherwise specified, noted or approved.
- C. Color coded in accord with the following table:

System Voltage	ØA	ØB	ØC	Neutral	Ground
120/208 Wye	Black	Red	Blue	White	Green
120/240 Delta	Black	Orange	Red	(Wild)White	Green
270/480 Wye	Brown	Yellow	Purple	Gray	Green

- 1. Auxiliary systems shall each have their own color coding throughout the respective systems.
- D. Circuits run and numbered to agree with drawings. Combining of circuits other than what is shown on drawings is unacceptable.
- E. Feeders

1. Splices in feeders are not permitted.
2. Perform an insulation resistance test on all feeder conductors installed under this contract, including neutrals, using a megohmmeter. Apply 1,000 volts DC to each conductor and maintain for one minute. Minimum value for each conductor shall be 100 megohms at 60 degrees F. Insulation test is to be made between conductors and between conductors and ground.

SECTION 261100 - RACEWAYS AND FITTINGS

PART 1 GENERAL

1.1 WORK INCLUDED

- A. The work in this Section includes conduit systems where required for power, lighting and other systems requiring raceways.
- B. Systems included, but not limited to, are alarm, telephone, TV, communication, music clock, monitors, grounding, security and others noted on the drawings.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Rigid conduit shall be galvanized rigid steel conforming to Federal Specification No. WW-C-581.
 - 1. Conduit run underground shall be galvanized rigid steel as listed above, and shall be asphalt-coated or PVC-coated.
 - 2. Exterior underground conduit may be PVC as permitted by NEC.
- B. Intermediate metal conduit may be used only as permitted by the National Electric Code.
- C. EMT shall be galvanized steel conforming to Federal Specification No. WW-C-563. May only be used where rigid steel is not called for or required by Code.
 - 1. Connectors and fittings up through 2" size to be steel compression type (cast metal is not acceptable). Setscrew type is not acceptable up through 2" size.
 - 2. Connectors and fittings shall be watertight in wet locations and concrete tight in concrete and masonry.
- D. Flexible conduit shall be galvanized flexible steel conduit conforming to Federal Specification No. WW-C-566. Use polyvinyl and Neoprene-covered, waterproof type with waterproof connectors for exterior use and wet areas.
- E. Insulated bushings shall be O-Z/Gedney Type B, SB or SBT as required.
- F. Exterior underground conduit may be PVC as permitted by NEC.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Raceways used throughout construction for all conductors unless otherwise specifically indicated. Separate raceway systems shall be used for each auxiliary system such as telephone, exit lights, fire alarm, communication or signal system.
- B. Flexible metal conduit shall be used for connections to motors and equipment. Minimum length of 12". Maximum length for connections to motor driven equipment - 36", maximum length for connection to light fixtures - 5'-0".

- C. All conduits shall be provided with locknuts and insulated throat connectors.
- D. Conduit shall be concealed in finished spaces, unless otherwise indicated.
- E. Installation of raceways to be coordinated with installation of other trades, in particular, ductwork and piping. Location of mechanical equipment and systems to take precedence over raceways location. Installation shall not restrict equipment maintenance space or access thereto.
- F. Hanging of raceways done in first-class manner using conduit clamps, Unistrut brackets, racks, etc., or other approved methods. Hanging off suspended ceiling support wires or resting on ceiling support system or ceiling material is not permitted. Installation shall not interfere with removable ceiling panels or access openings.
- G. Surface raceways such as Wiremold and exposed conduit shall be run parallel and/or perpendicular with walls. Use appropriate factory fittings on Wiremold for changes in direction, terminations and connections.
- H. Annular openings around conduit penetrating fire barriers such as floors, fire rated walls and fire rated ceilings shall be fire-stopped as specified in Section 260000.

3.2 GROUNDING RACEWAY SYSTEM

- A. All noncurrent-carrying metallic parts of electrical equipment and all raceway systems shall be grounded.
- B. Ground raceway systems and cabinets for auxiliary systems by bonding or by conduit interconnection with the electrical system or as otherwise specifically indicated on the drawings.
- C. Run a ground wire with all conduit properly connected at each end with approved fittings with binding screw.

END OF SECTION 261100

SECTION 261300 - BOXES

PART 1 GENERAL

1.1 COORDINATION

- A. It is the Contractor's responsibility to verify door swings on the job before roughing-in for switches at doors. Locate on lock side of door.

1.2 CIRCUIT IDENTIFICATION

- A. Each junction box shall have all circuit numbers in that particular box noted on the cover. On exposed galvanized boxes with galvanized covers, such as above accessible ceilings and in unfinished spaces, the circuit numbers shall be on the outside of the cover. On flush boxes in finished spaces the numbers shall be noted on the inside of the cover. Use Seton style NLO vinyl cloth markers, 5/8" letters on 9/16" x 3/4" marker.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Zinc-coated or cadmium-plated Code gauge sheet steel, minimum depth 2-1/8" except at structural restrictions. Sizes to be in accord with the National Electrical Code.
 - 1. At contractor option; Plastic boxes may be used where permitted by the NEC.
- B. Boxes for metallic raceways, 4-inch by 4-inch nominal size and smaller shall be of the cast-metal hub type when located in normally wet locations, when surface mounted on outside of exterior surfaces, when located in hazardous areas, or when installed exposed up to 7 feet above interior floors and walkways.
- C. Junction or pull boxes which are less than 150 cubic inches in size, shall be the same as outlet boxes.
- D. Special boxes as required to be used for special systems as specified, noted on the drawings or as required.

PART 3 EXECUTION

3.1 INSTALLATION

- A. All metallic boxes to be effectively grounded.
- B. Check other drawings, shop drawings, etc., to determine that switches and outlets are not concealed behind cabinet work, doors, heating units, etc.
- C. It is this Contractor's responsibility to see that boxes in walls are straight, level, plumb and flush with finished surfaces. Use box extensions where box is set too deep.
- D. Open junction boxes are not acceptable. All boxes shall have an appropriate cover for the location.
- E. Mounting heights from finished floor to center of outlet.
 - 1. General wall switches - 4'-0" (unless otherwise noted on the drawings).

2. Convenience outlets - 15" (except at cabinets, counters, etc., or as noted on the drawings).
3. Special systems devices - as required and/or as noted on drawings.

3.2 NOISE TRANSMISSION

- A. Where boxes are mounted in a common wall, they shall, where possible, be offset horizontally so that they are not mounted back-to-back. Connect offset boxes with flexible conduit not to exceed 18" in length. Where it is not practical to offset boxes, with permission they may be mounted back-to-back with a minimum clearance of 1/4" between boxes and with a sheet of high density fiberglass between boxes. Connect boxes with flexible conduit. Do not nipple boxes mounted back-to-back.

END OF SECTION 261300

SECTION 261410 - WIRING DEVICES

PART 1 GENERAL

1.1 SELECTION OF DEVICES

- A. Various switches, outlets and devices are to be as specified herein or as approved, and as determined from the legend on the drawings. All like devices to be of the same manufacturer.
- B. All exposed devices shall be white.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Wall Plates
 - 1. Smooth plastic. Plate color to match device color.
 - 2. Blank plates and telephone plates to match other plates in the respective rooms.
- B. Switches
 - 1. Leviton or equal.
- C. Receptacles
 - 1. Convenience receptacles to be Leviton or equal. 120V.
 - 2. Dryer Outlet (30-Amp)
Receptacle – Leviton or equal.
Coordinate with appliance.
 - 3. Range Outlet (50-Amp)
Receptacle – Leviton or equal. .
Coordinate with appliance.
- D. Device and Plate Colors
 - 1. White
- E. Time Clocks – As noted on drawings, or as approved.
- F. Photoelectric switches - As noted on the drawings, or as approved.
- G. Special Outlets - NEMA configuration as noted on drawings. (Provide matching cord cap to Owner.)
- H. Doorchimes
 - a. Accessible Room:
 - i. Button: Surface mounted; wireless push button, battery. Nutone PB75SN (Satin Nickel Finish).
 - ii. Accessible Rooms; Plug in, Lighted and audible; Nutone LA204RWH, (White).
Provide two receivers for each accessible unit.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Plates shall be plumb and fit tight to wall.
- B. Duplex Receptacles
 - 1. 15-amp and 20-amp receptacles are listed in the schedule of wiring devices. In general, the 15-amp receptacle is to be used, however, the 20-amp receptacle shall be used when so indicated on the drawings and/or where required by Code, such as the only outlet on a 20-amp circuit.
- C. Grounding
 - 1. Bond receptacle grounding terminals to the raceway system in accordance with the National Electrical Code.
- D. Door Chimes
 - 1. Install fully complete with all accessories as required.
 - 2. Provide power to transformer from a nearby unswitched circuit.

END OF SECTION 261410

SECTION 261550 - DISCONNECTS AND MOTOR CONTROLS

PART 1 GENERAL

1.1 WORK INCLUDED

- A. This Section covers furnishing and installing motor starters, disconnects and other motor protective equipment and control devices as noted on the drawings.
- B. Motor starter heater elements of the proper size in accord with motor nameplate data shall be installed in the starters.

1.2 CODE REQUIREMENTS

- A. All units shall have disconnects to meet the requirements of the National Electrical Code.

1.3 IDENTIFICATION

- A. Where the use is not obvious, identify all single disconnects and starters as to equipment served, voltage, phases, etc., using pressure-sensitive tape punched with tapewriter. Identify feeder source such as "Ckt. #5 Panel 'A' Mech. Rm. 110." All devices in motor control centers and all VFD's shall have laminated identification plates.

1.4 SUBMITTALS

- A. Shop Drawings
 - 1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
 - 2. Include electrical ratings, dimensions, mounting, materials, running overcurrent protection, branch circuit overcurrent protection, wiring diagrams, starting characteristics, interlocking, and accessories. Provide bussing diagrams and layout drawings for motor control centers.
 - 3. Provide manufacturer's literature and wiring diagrams for variable frequency drives. List features, operation, and all installation cautions.
- B. Manuals
 - 1. Complete operating and maintenance manuals shall be provided including technical data sheets, wiring diagrams, and information for ordering replacement parts. Deliver four copies of the above data to the Engineer prior to final inspection.
 - a. Wiring diagrams shall have their terminal identified to facilitate installation, operation, and maintenance.
 - b. Wiring diagrams shall indicate internal wiring for each item of equipment and interconnections between the items of equipment.
 - c. Elementary schematic diagrams shall be provided for clarity of operation.

PART 2 PRODUCTS

2.1 QUALITY ASSURANCE

- A. For conventional starters and disconnect, equivalent products to those specified as manufactured by Square-D, General Electric, Westinghouse, Siemens, Cutler-Hammer, and Allen Bradley are acceptable.
- B. The horsepower ratings indicated on electrical plans are for guidance only and do not limit the equipment size. When electrically driven equipment furnished under other sections of these specifications materially differs from the contemplated design, the Contractor shall make the necessary adjustments to the wiring, disconnect devices and branch-circuit protection to accommodate the equipment actually installed.

2.2 MATERIALS

A. Starters

- 1. Type and size as indicated on the drawings. NEMA enclosure to suit location. Provide control devices, switches, pilots and interlocks as required.
- 2. Protection for all ungrounded legs required. Relays sized for the actual motor connected thereto.
- 3. Starters shall be fully NEMA rated and shall have 120-volt coils. Provide a transformer in the starter when necessary to obtain 120 volts.

B. Disconnects

- 1. Type and size as indicated on the drawings and/or as required by Code. NEMA enclosure to suite location.
- 2. Safety switch type: Heavy duty type with number of blades, poles as required by the service. Switches to be fusible, unless noted otherwise, and with Buss fusetrons as required by equipment served.
- 3. Fustat and toggle switch type: Buss No. SSU fustat and single-pole switch unit. Provide fustats as required by equipment served.

C. Fuses

- 1. Provide fuses in the motor disconnect means and protective devices for motor short circuit current protection in accord with Article 430 of the National Electrical Code.

2.3 MOTOR CONTROL CENTER

- A. Square-D Type 8998 NEMA 1, Class B, Rating of Buss as noted for [120/208 volt] [277/480 volt], 3 4-wire current
- B. Center shall have an interrupting rating of not less than 22,00 symmetrical amp.
- C. Each vertical section shall be a maximum of 20" wide and 90" high, and have the capability of containing six Size 1 combination starter units.
- D. Each section shall contain a vertical wire trough having a cross section of not less than 189 square inches and shall extend from top wire trough to bottom wire trough and be isolated from the buss bars. Vertical trough to have hinged cover for easy access.
- E. Load wire shall be connected to pull-apart terminal blocks mounted in vertical wire trough for

easy removal of individual units.

- F. Each individual unit shall have flanged operating handle independent of unit door and capable of being locked in either on or off position.
- G. Insulated horizontal and vertical buss barriers shall be furnished to reduce hazard of accidental contact. Small, separate openings in the barriers shall permit unit plug-in contacts to pass through and engage the vertical buss bars. Unused plug-in openings shall have plastic snap-in closing plates for added safety. Bottom buss covers shall be provided below the vertical buss to protect the ends of this buss from contact with fish tapes or other items entering the bottom of the enclosure.
- H. All magnetic starters shall be fully NEMA rated and shall have three overload relay thermal units of the bimetallic type and additional interlocks as required for the operation described.
- I. All combination starters in motor control centers shall be the MCP circuit breaker type.
- J. Provide special sections, breakers, transformers, and panels as noted on drawings of control centers.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Rough-in for and connect up all electrical equipment.
- B. Provide starters and motor protection for equipment as noted on the drawings.
- C. Make connections to motors and equipment with flexible conduit. Refer to Section 16110.
- D. Ground noncurrent carrying parts of mechanical equipment.
- E. Refer to notes on the drawings and to the Specifications to determine equipment, starters, devices, etc., to be furnished by the respective suppliers and contractors.
 - 1. Mount starters and other electrical devices shipped loose with equipment and connect up. Make provisions for and connect up "packaged" equipment when it is assembled on the job.

3.2 MOUNTING

- A. Refer to Section 16000 for requirement for mounting and anchoring equipment.
- B. Provide concrete bases for all floor-mounted equipment as outlined in Section 16000.

END OF SECTION 261550

SECTION 261600 - PANELBOARDS

PART 1 GENERAL

1.1 IDENTIFICATION

- A. Provide laminated plastic nameplates 3" wide by 1-1/4" high with 1/4" letters on each panel and contactor panel, giving panel letter and current characteristics, source of feed and size of feed. State use of each contactor, where not obvious.

Example: PANEL B
 120/208 VOLTS, 3Ø, 4W
 MDB-1 #3/0

1.2 SUBMITTALS

- A. Submittals shall include specified panel layouts, bussing diagrams, breaker data with trip curves and enclosure data.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. In general, equivalent products of Square-D, General Electric are acceptable.

2.2 MATERIALS

A. Load Center Panels

1. These panels shall be Square-D Loadcenters, or as approved, with 10,000 AIC rated QO circuit breakers.
2. Tandem and 1/2" breakers are not acceptable.

B. Branch Circuit Panels

1. Branch circuit panels shall be one of the following, as required by the system voltage: Breakers shall be rated at not less than 10,000 AIC.
2. Panelboards shall be full 20" wide. Narrower panels, such as the 14" wide product, are not acceptable unless they are specifically so noted on the drawings.
3. Panels to have concealed trim clamps, doors with concealed hinges and flush lock, master keyed.

C. Distribution Panels

1. This panel shall be one of the following: Breakers shall be rated at not less than 22,000 AIC.

2.3 GENERAL PANEL REQUIREMENTS

- A. Each panel shall have a ground buss.
- B. Gutters and wire bending spaces shall be sized in accordance with the latest NEC requirements.

- C. Multi-pole breakers shall be common trip, single handle.
- D. Dead front type, voltage characteristics as noted.
- E. Circuiting, circuit numbering and panel layout to be as indicated.
- F. Panels, mains, feeder location, mounting, size and number of breakers to be as indicated.
- G. Provide breakers of size noted in spaces marked "spare".
- H. Make provisions for breakers to be mounted in spaces marked "provision".
- I. When required by a special application, such as dimmer and motor circuits, the branch circuit breaker shall be specially rated for that service.
- J. A panels shall have main disconnects.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Provide typewritten circuit directory with panel. Fill out in such manner as described load on each circuit and the area served, such as "lights, office, Rm. #3."
- B. Panels mounted true and securely anchored to wall. Unless otherwise indicated panels shall be recessed.
- C. Circuits may be modified in panel at contractor option. Adjust panel schedule to indicate actual circuiting.

3.2 GROUNDING

- A. The ground connection shall be made at the main service equipment and shall be extended to the point of entrance of the metallic water service. Connection to the water pipe shall be made by connecting on the street side of the water meter. The water service ground shall be supplemented with a driven ground rod (5/8" X 8' long copper-clad steel) connected to the service ground. Connections shall be made with suitable ground clamps or by a thermo-weld process.
- B. Scratch paint off on inside where conduit locknuts bind so that good ground connection is achieved with conduit.
- C. Install ground wedges or grounding bushings with ground wire clamps on all conduits in main distribution panel. Connect with ground wires to ground buss.

END OF SECTION 261600

SECTION 265000 - LIGHTING FIXTURES

PART 1 GENERAL

1.1 QUALITY ASSURANCE

- A. Fixtures and components to be UL listed and labeled.
- B. Fixtures shall be furnished complete in all respects including canopies, stems, hickey, casings, sockets, holders, reflectors, ballasts, lens, frames, boxes, plaster frames, lamps, etc., for complete fixture. Provide the components required for complete and satisfactory installation, whether or not called out specifically. Where screw in compact fluorescent fixtures are specified, CFL lamps shall be included.
- C. Guarantee, Warranty
 - 1. Ballasts and lamps for fluorescent and HID fixtures shall be fully warranted for one year, ballasts for 3 years, including parts and labor from date of approved substantial completion.

1.2 COORDINATION

- A. Prior to releasing fixtures for shipment, the Contractor shall coordinate fixture types with ceiling types and make to ascertain compatibility of fixtures and ceilings. Any inconsistencies shall be promptly brought to the attention of the Engineer prior to ordering fixtures or equipment.

PART 2 PRODUCTS

2.1 LIGHTING FIXTURES

- A. Refer to notes on the drawings and/or the Lighting Fixture Schedule for basic fixture designations. Note some fixtures to be furnished with finish package and installed by the electrical contractor.
- B. Suspended fixtures shall include mounting assembly for mounting to box support, not box alone.
- C. Substitute fixtures shall be of equal or greater quality.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Wiring to be in strict accord with the National Electrical Code and manufacturer's recommendations.
- B. Conductors used in conjunction with light fixtures shall be in accord with the National Electrical Code and such conductors used in the following applications shall be listed for use as "Fixture Wire" with a temperature rating equal to that used in the particular fixture, and capacity equal to the branch circuit protection.
 - 1. Channels in fluorescent fixtures used as raceway.
 - 2. In conduit to first junction outside fluorescent fixture channel.

- 3. In flexible conduit from fixture to associate junction box.
- C. Set true, free of light leaks, warpage, dents, etc.
- D. Noisy or defective ballasts, lamps, etc., replaced.
- E. Damaged fixtures shall not be installed until inspected by the Engineer. Approved fixtures may then be installed, rejected fixtures replaced with new ones.
- F. Supporting and special mounting provisions as noted on drawings and as required.
- G. Use flexible conduit for connecting to "lay-in" fixtures, as noted on the drawings and as required. Run ground wire with flex, end-to-end, and connect for continuous and reliable ground.

END OF SECTION 265000

SECTION 267230 - DIGITAL FIRE ALARM SYSTEM

PART 1 GENERAL

1.1 SYSTEM REQUIREMENTS

- A. The fire alarm system shall be designed to facilitate it being maintained in operable condition at all times and to facilitate it being tested periodically.
- B. Install a complete Fire Alarm System as specified herein and as indicated on the drawings. Work includes connection to fire sprinkler system equipment. Coordinate with fire sprinkler contractor as required.
- C. Provide additional items as necessary for a fully complete and operational system. The fire alarm system is required to comply with all governing codes and regulations including NFPA, IBC and IFC.
- D. Provide a single branch circuit connection for supplying power to the systems.
- E. The major pieces of equipment, including Fire Alarm Control Panels and Annunciater shall be the product of one manufacturer who shall be completely responsible for the satisfactory operation of all systems.
- F. Contractor shall be responsible for preparation of fully complete shop drawings and equipment submittals designed by a fire alarm certified NICET professional. Shop drawings shall be completed using a digital drafting program, hand drawings are not acceptable. Building floor plans will be made available to the contractor in Autocad format. Contractor shall submit drawings and equipment submittals to the local jurisdiction for permitting.
- G. Any items and equipment shown on the drawings are the minimum requirements of the system intended to show additional requirements of the fire alarm system. The final design of fire alarm systems shall be completed by the contractor.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Provide all materials and equipment for a fully complete and operational fire alarm system.

PART 3. EXECUTION

3.1 INSTALLATION

- A. Install all material and equipment as required for a fully complete system. All wiring shall be concealed in building construction.
- B. The Contractor shall make all repairs to the existing surfaces as required due to installation of his work.

C. All installed equipment and material shall be properly supported.

3.2 GUARANTEES

A. The fire alarm contractor shall provide a full 2- year warranty on all labor and parts.

END OF SECTION 267230

SECTION 267400 – TELEPHONE/DATA – TELEVISION SYSTEMS

PART 1 GENERAL

1.1 WORK INCLUDED

- A. The work included in this section includes the telephone, data and television systems.
- B. Work includes all cable, boxes and termination devices. Telephone, TV and internet equipment within the PBX room to be provided by others.
- C. Perform pre rough-in walkthrough with the owner to determine exact locations of telephone and television systems.

PART 2 PRODUCTS

2.1 TELEPHONE/DATA

- A. Provide all cable/wire, boxes and plates as required. Plate color to match other device plates.
- B. All wire shall be Cat 6. Devices shall be designed for Cat 6.

2.2 TELEVISION

- A. Provide all cable, boxes and plates as required. Plate color to match other device plates.
- B. Unless otherwise approved, provide RG59/U cable and compatible devices.

2.3 WIRELESS ACCESS POINTS

- A. INDOOR
 - 1. Cisco Aironet 3800 or equal.
 - 2. Provide with all required hardware as required for installation and operation.
- B. OUTDOOR
 - 1. Cisco Aironet 1560 or equal.
 - 2. Provide with all required hardware as required for installation and operation.

PART 3 EXECUTION

3.1 COOPERATION

- A. The Contractor shall complete his work promptly and expediently as permitted by general construction progress.
- B. Cooperate with the telephone and cable systems providers in the installation of their equipment.
- C. Provide conduits into the building as needed for the phone and cable systems providers. Coordinate installation to allow conduit to be installed below grade and through footings into PBX room. Provide a minimum of (4) 4" pvc conduits with long sweep elbows from exterior

into PBX room.

- D. All cables shall homerun to the PBX room. Coordinate termination location with equipment in PBX Room.

3.2 TELEPHONE/DATA

- A. Provide a dedicated cable (homerun) from each phone jack.
- B. Provide a dedicated cable (homerun) from each data jack.

3.3 TELEVISION

- A. Provide TV outlets at locations indicated on drawings. Provide a coaxial homerun from each TV location. Spliced cables are not acceptable.

SECTION 268500 - ELECTRIC HEAT

PART 1 GENERAL

1.1 QUALITY ASSURANCE

- A. All units UL approved.
- B. Units provided with all controls such as safety switches, thermal cutouts, transformers, contactors, etc., as required for safe and satisfactory operation.

1.2 SUBMITTAL DATA

- A. See Section 260000 for general submittal requirements.
- B. Provide manufacturer's literature for all products specified in this Section which will be installed under this project.

PART 2 PRODUCTS

2.1 MATERIALS - GENERAL

- A. Refer to the respective schedules on the drawings for sizes, types, capacities and ratings.
- B. All units furnished and installed complete in all respects.
- C. Provide wall-mounted or unit-mounted thermostats as indicated for each unit. Provide transformers, contactors, etc., as required.
- D. Fractional horsepower motors provided with built-in thermal protection on all speeds. Units provided with switches and factory wiring.
- E. Provide all clips, end pieces, connectors, filler pieces, brackets, etc., for a complete installation.

2.2 CABINET HEATERS

- A. The heating equipment shall include an electric automatic fan forced air heater suitable for large area heating, as manufactured by Qmark, Markel, Berko, or approved equal. The heater shall be designed for wall or ceiling mounting, recess or surface. Heaters shall be UL listed.
- B. The heater assembly which fits into the back box shall consist of a fan panel upon which is mounted all of the operational parts of the heater.
- C. The heating element shall be of the non-glowing design consisting of an 80/20 nickel-chromium resistance wire enclosed in a steel sheath to which plate fins are copper brazed. It shall be warranted for 5 years.
- D. The fan motor shall be totally enclosed.

- E. Fan control shall be of bimetallic, snap-action type and shall activate fan after heating element reaches operating temperature. The fan shall continue to operate after the thermostat is satisfied and until the heating element is cool.
- F. The tamper-proof thermostat (where indicated) shall be of the bi-metallic, snap-action type with enclosed contacts. It shall be completely concealed behind the front cover to become tamper proof.
- G. A thermal cutout shall be built into the system to shut off the heater in the event of over heating.
- H. A double pole single throw disconnect switch shall be mounted on the back box for positive disconnect of power supply. It will be completely concealed behind the front grid panel.
- I. The back box shall be designed for duty as a recessed rough-in box in either masonry or frame installations and is also used with the surface mounting frame in surface mounting installations. The back box shall be 20-gauge galvanized steel and shall contain knockouts through which power leads are brought.
- J. The front panel shall be of the bar grille type and shall be constructed of 16-gauge cold rolled steel, welded into a uniform grille and finished in baked enamel to direct the warmed air toward the floor. The front grille shall be surrounded by a decorative satin-finish aluminum "picture" frame.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Units to fit snugly and securely to walls and ceilings. Coordinate with General Contractor for providing proper size openings and anchorage/support for the units.
- B. Coordinate installation with other trades to get proper rough-in and connections of units and controls.
- C. Scratched, dented, and otherwise damaged units to be put in first-class condition before acceptance. Access doors, fronts, and filters to be easily opened or removed without binding.

3.2 TESTING

- A. Units shall be observed during normal system operation after all balancing is complete. Any excessive noise indicating loose belts, bad bearings, etc., shall be corrected.

END OF SECTION 268500