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SECTION 01200 - PRICE AND PAYMENT PROCEDURES PART 1 GENERAL

1.1 SECTION INCLUDES

A. Procedures for preparation and submittal of applications for progress payments.

B. Procedures for preparation and submittal of application for final payment.

1.2 RELATED REQUIREMENTS

A. Section 01210 - Allowances: Payment procedures relating to allowances.

B. Section 01270 - Unit Prices: Monetary values of unit prices, payment and modification procedures relating to unit prices.

1.3 SCHEDULE OF VALUES

A. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit sample 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.

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

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

1.4 APPLICATIONS FOR PROGRESS PAYMENTS

A. Each Application for Payment shall be consistent with previous applications and payments as certified by Construction Manager and paid for by Owner.
   1. 1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

B. Payment Period: Submit at intervals stipulated in the Agreement.

C. Payment Application Forms: Use forms provided by Owner for Applications for Payment. Forms shall be provided to the Contractor at the Pre-Construction Conference.

D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Owner will return incomplete applications without action.
   1. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions were made.

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

F. Forms filled out by hand will not be accepted.

G. For each item, provide a column for listing each of the following:
   2. Item Number.
   3. Description of work.
   4. Scheduled Values.
   5. Previous Applications.
   6. Work in Place and Stored Materials under this Application.
   7. Authorized Change Orders and Construction Change Directives.
   8. Total Completed and Stored to Date of Application.
   9. Percentage of Completion.
   10. Balance to Finish.
   11. Retainage.

H. Execute certification by signature of authorized officer.

I. 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.

J. List each authorized Change Order as a separate line item, listing Change Order number and dollar amount as for an original item of Work.

K. Submit three copies of each Application for Payment.

L. Include the following with the application:
   1. Transmittal letter as specified for Submittals in Section 01300.
   2. Construction progress schedule, revised and current as specified in Section 01300.
   3. Current construction photographs specified in Section 01300.
   4. Affidavits attesting to off-site stored products.

1.5 APPLICATION FOR FINAL PAYMENT

A. Application for Payment at Substantial Completion: After issuing the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
   1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.

B. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
   1. Evidence of completion of Project closeout requirements.
   2. Insurance certificates for products and completed operations where required and proof
   3. that taxes, fees, and similar obligations were paid.
   4. Updated final statement, accounting for final changes to the Contract Sum.
   5. Completed "Release of Liens" forms.
   6. AIA Document G707, "Consent of Surety to Final Payment."
   7. Evidence that claims have been settled.

8. Final meter readings for utilities and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
9. Final, liquidated damages settlement statement.

END OF SECTION 01200

SECTION 01210 - ALLOWANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements governing allowances.
   1. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when additional information is available for evaluation. If necessary, additional requirements will be issued by Change Order.

B. Types of allowances include the following:
   1. Lump-sum allowances.
   2. Unit-cost allowances.
   3. Quantity allowances.

C. Related Sections include the following:
   1. Division 1 Section "Contract Modification Procedures" for procedures for submitting and handling Change Orders for allowances.
   2. Division 1 Section "Unit Prices" for procedures for using unit prices.
   3. Division 1 Section "Quality Requirements" for procedures governing the use of allowances for testing and inspecting.
   4. Divisions 2 through 16 Sections for items of Work covered by allowances.

1.3 ELECTION AND PURCHASE

A. At the earliest practical date after award of the Contract, advise Architect of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.

B. At Architect's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.

C. Purchase products and systems selected by Architect from the designated supplier.

SECTION 01400 - QUALITY REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. References and standards.

B. Quality assurance submittals.

C. Mock-ups.

D. Control of installation.

E. Tolerances.

F. Testing and inspection services.

G. Manufacturers' field services.

1.2 RELATED REQUIREMENTS

A. Section 01300 - Administrative Requirements: Submittal procedures.

B. Section 01600 - Product Requirements: Requirements for material and product quality.

1.3 REFERENCE STANDARDS

A. ASTM C 1021 - Standard Practice for Laboratories Engaged in Testing of Building Sealants; 2008.

B. ASTM C 1077 - Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation; 2009.

C. ASTM C 1093 - Standard Practice for Accreditation of Testing Agencies for Masonry; 2009.

D. ASTM D 3740 - 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; 2008.

E. ASTM E 329 - Standard Specification for Agencies Engaged Construction Inspection and/or Testing; 2009.

F. ASTM E 543 - Standard Specification for Agencies Performing Nondestructive Testing; 2009.

1.4 SUBMITTALS

A. Design Data: Submit for Architect's knowledge as contract administrator for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents, or for Owner's information.

B. Test Reports: After each test/inspection, promptly submit two copies of report to Architect and to Contractor.
   1. Test report submittals are for Architect's knowledge as contract administrator for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents, or for Owner's information.

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.

F. Erection Drawings: Submit drawings 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.

1.5 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.

1.6 TESTING AND INSPECTION AGENCIES

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

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

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 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 the 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.

3.2 MOCK-UPS

A. Tests will 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, remove mock-up and clear area when directed to do so.

3.3 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.

D. Adjust products to appropriate dimensions; position before securing products in place.

3.4 TESTING AND INSPECTION

A. See individual specification sections for testing 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 assume any duties of Contractor.

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.

3.5 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 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.

3.6 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 01400

SECTION 01410 - STRUCTURAL TESTS AND SPECIAL INSPECTIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements required for compliance with the International Building Code, Chapter 17, Structural Tests and Special Inspections.

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

C. The owner will engage one or more qualified special inspectors and / or testing agencies to conduct structural tests and special inspections specified in this section and related sections and as maybe specified in other divisions of these specifications.

D. Related Sections include but are not limited to the following:
   1. 03300 CAST-IN-PLACE CONCRETE.
   2. 04810 MASONRY
   3. 05120 STRUCTURAL STEEL.
   4. 05310 STEEL DECK.
   5. 05450 LIGHT GAGE STEEL TRUSSES

1.3 DEFINITIONS

A. Approved Agency: An established and recognized agency regularly engaged in conducting tests or furnishing inspection services, when such agency has been approved by the building official.

B. Construction Documents: Written, graphic and pictorial documents prepared or assembled for describing the design, location and physical characteristics of the elements of a project necessary for obtaining a building permit. Construction Documents include all supplemental instructions, sketches, addenda, and revisions to the drawings and specifications issued by the registered design professional beyond those issued for a building permit.

C. Shop Drawings / Submittal Data: Written, graphic and pictorial documents prepared and / or assembled by the contractor based on the Construction Documents.

D. Structural Observation: Visual observation of the structural system by a representative of the registered design professional's office for general conformance to the approved construction documents. Structural observations are not considered part of the structural tests and special inspections and do not replace inspections and testing by the testing agency or special inspector.

E. Special Inspector: A qualified person who demonstrating competence, to the satisfaction of the code enforcement official and registered design professional in responsible charge, for inspection of the particular type of construction or operation requiring special inspection. The special inspector shall be a licensed professional engineer or engineering intern or a qualified representative from the testing agency.

F. Special Inspection, Continuous: The full-time observation of work requiring special inspection by an approved special inspector who is present in the area where the work is being performed.

G. Special Inspection, Periodic: The part-time or intermittent observation of work requiring special inspection by an approved special inspector who is present in the area where the work has been or is being performed and at the completion of the work.

H. Testing Agency: A qualified materials testing laboratory under the responsible charge of a licensed professional engineer, approved by the code enforcement official and the registered design professional in responsible charge, to measure, examine, test, calibrate, or otherwise determine the characteristics or performance of construction materials and verify confirmation with construction documents.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications:
   1. Minimum qualifications of inspection and testing agencies and their personnel shall comply with ASTM E329-03 Standard Specification for Agencies in the Testing and / or Inspection of Materials Used in Construction.
      a. Inspectors and individuals performing tests shall be certified for the work being performed as outlined in the appendix of the ASTM E329. Certification by organizations other than those listed must be submitted to the building official for consideration before proceeding with work.
   2. In addition to these requirements, local jurisdiction may have additional requirements. It is the responsibility of the testing and inspection agencies to meet local requirements and comply with local procedures.

1.5 CONFLICTING REQUIREMENTS, REPORTS, AND TEST RESULTS

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

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

C. The special inspector's reports and testing agencies results shall have precedence over reports and test results provided by the contractor.

D. Where a conflict exists between the construction documents and approved shop drawings / submittal data, the construction documents shall govern unless the shop drawings / submittal data are more restrictive. All conflicts shall be brought to the attention of the registered design professional in responsible charge.

1.6 SUBMITTALS BY SPECIAL INSPECTOR AND / OR TESTING AGENCY

A. Special inspectors shall keep and distribute records of inspections. The special inspector shall furnish inspection reports to the building official, and to the registered design professional in responsible charge, contractor, architect, and owner. Reports shall indicate that work inspected was done in conformance to approved construction documents. Discrepancies shall be brought to the immediate attention of the contractor for correction. If the discrepancies are not corrected, the discrepancies shall be brought to the attention of the building official and to the registered design professional in responsible charge prior to the completion of that phase of the work. A final report documenting required special inspections and correction of any discrepancies noted in the inspections shall be submitted at a point in time agreed upon by the permit applicant and the building official prior to the start of work.
   1. Special inspection reports and test results shall include, but not be limited to, the following:
      a. Date of inspection.
      b. Description of inspections or tests performed including location (reference grid lines, floors, elevations, etc.).
      c. Statement noting that the work, material, and / or product conforms or does not conform to the construction document requirements.
         1) Name and signature of contractor's representative who was notified of work, material, and / or products that do not meet the construction document requirements.
      d. Name and signature of special inspector and / or testing agency representative performing the work.

B. Schedule of Non-Compliant Work: Each agent shall maintain a log of work that does not meet the requirements of the construction documents. Include reference to original inspection / test report and subsequent dates of re-inspection / retesting.

C. Reports and tests shall be submitted within 1 week of inspection or test. Schedule of Non-Compliant Work shall be updated daily and submitted at monthly intervals.

D. Final Report of Special Inspections. Submitted by each agent listed in the schedule of Structural Testing and Special Inspections.

PART 2 - PRODUCTS (not used)

PART 3 - EXECUTION

3.1 CONTRACTOR'S RESPONSIBILITY

A. The contractor shall coordinate the inspection and testing services with the progress of the work. The contractor shall provide sufficient notice to allow proper scheduling of all personnel. The contractor shall provide safe access for performing inspection and on site testing.

B. The contractor shall submit schedules to the owner, registered design professionals and testing and inspecting agencies. Schedules will note milestones and durations of time for materials requiring structural tests and special inspections.

C. The contractor shall repair and / or replace work that does not meet the requirements of the construction documents.
   1. Contractor shall engage an engineer / architect to prepare repair and / or replacement procedures.
   2. Engineer / architect shall be registered in the state in which the project is located. Engineer shall be acceptable to the registered design professional in responsible charge, code enforcement official, and owner.
   3. Procedures shall be submitted for review and acceptance by the registered design professional in responsible charge, code enforcement official, and owner before proceeding with corrective action.

D. The contractor shall be responsible for costs of:
   1. Re-testing and re-inspection of materials, work, and / or products that do not meet the requirements of the construction documents and shop drawings / submittal data.
   2. Review of proposed repair and / or replacement procedures by the registered design professional in responsible charge and the inspectors and testing agencies.
   3. Repair or replacement of work that does not meet the requirements of the construction documents.

3.2 STRUCTURAL OBSERVATIONS

A. Structural observations may be made periodically as determined by the registered design professional in responsible charge.

3.3 TESTING AND INSPECTION

A. Testing and inspection shall be in accordance with the Schedule of Special Inspections. See Structural Drawings for Schedule.

B. Reference related specifications for the minimum level of inspections and testing. Provide additional inspections and testing as necessary to determine compliance with the construction drawings.

PART 4 - SCHEDULE (SEE DRAWING S1.3) AND FORMS (ATTACHED)

4.1 STATEMENT OF SPECIAL INSPECTIONS.

4.2 FINAL REPORT OF SPECIAL INSPECTIONS.

END OF SECTION 01410

SECTION 01500 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes requirements for temporary facilities and controls, including temporary utilities, support facilities, and security and protection facilities.
   1. Temporary utilities include, but are not limited to, the following:
      a. Water service and distribution.
      b. Sanitary facilities, including toilets, wash facilities, and drinking-water facilities.
      c. Heating and cooling facilities.
      d. Ventilation.
      e. Electric power service.
      f. Lighting.
      g. Telephone service.
   2. Support facilities include, but are not limited to, the following:
      a. Project identification and temporary signs.
      b. Waste disposal facilities.
      c. Field offices.
      d. Storage and fabrication sheds.
      e. Lifts and hoists.
      f. Temporary stairs.
      g. Construction aids and miscellaneous services and facilities.
   3. Security and protection facilities include, but are not limited to, the following:
      a. Environmental protection.
      b. Pest control.
      c. Security enclosure and lockup.
      d. Site enclosure fence.
      e. Barricades, warning signs, and lights.
      f. Fire protection.
   4. Related Sections include the following:
      a. Divisions 2 through 16 for temporary heat, ventilation, and humidity requirements for products in those Sections.

1.2 DEFINITIONS

A.

B. Permanent Enclosure: As determined by Architect, permanent or temporary roofing is complete, insulated, and weathertight; exterior walls are insulated and weathertight; and all openings are closed with permanent construction or substantial temporary closures.

1.3 USE CHARGES

A. General: Cost or use charges for temporary facilities are not chargeable to Owner or Architect and shall be included in the Contract Sum. Allow other entities to use temporary services and facilities without cost, including, but not limited to, the following:
   1. Owner's construction forces.
   2. Architect.
   3. Testing agencies.
   4. Personnel of authorities having jurisdiction.

B. Water Service: Use water from Owner's existing water system without metering and without payment of use charges.

C. Electric Power Service: Use electric power from Owner's existing system without metering and without payment of use charges.

1.4 QUALITY ASSURANCE

A. Standards: Comply with ANSI A10.6, NECA's "Temporary Electrical Facilities," and NFPA 241.
   1. Trade Jurisdictions: Assigned responsibilities for installation and operation of temporary utilities are not intended to interfere with trade regulations and union jurisdictions.
   2. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

1.5 PROJECT CONDITIONS

A. Temporary Utilities: At earliest feasible time, when acceptable to Owner, change over from use of temporary service to use of permanent service.
   1. Temporary Use of Permanent Facilities: Installer of each permanent service shall assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

B. Conditions of Use: The following conditions apply to use of temporary services and facilities by all parties engaged in the Work:
   1. Keep temporary services and facilities clean and neat.
   2. Relocate temporary services and facilities as required by progress of the work.

C. Parking:
   1. All Contractor vehicles must park within the designated fenced construction limits as indicated on the drawings. All personal vehicles must park within the fenced construction area, or as otherwise defined at the Pre-Bid Conference. Shuttle provisions for each Contractor's employees are the responsibility of each Contractor.
   2. A temporary parking permit, must be obtained for each unmarked vehicle which enters and/or parks on the campus. One representative from the Construction Manager will be authorized to obtain permits for this project.
   3. All vehicles, either company or personal, operating on the University campus must comply with the rules, regulations and directives of the University Department of Public Safety.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide new materials. Undamaged, previously used materials in serviceable condition may be used if approved by Architect. Provide materials suitable for use intended.

B. Chain-Link Fencing: Minimum 2-inch, 0.148-inch- thick, galvanized steel, chain-link fabric fencing; minimum 6 feet high with galvanized steel pipe posts; minimum 2-3/8-inch- OD line posts, with 1-5/8-inch- OD top rails, and 2-7/8-inch- OD corner and pull posts. Provide screen webbing for fencing fence along Lem Morrison Drive.
   1. All gates shall be welded units fabricated using a minimum of 1-5/8-inch-OD piping.

C. Tarpaulins: Fire-resistive labeled with flame-spread rating of 15 or less.

D. Water: Potable.

2.2 EQUIPMENT

A. General: Provide equipment suitable for use intended.

B. Field Offices: Mobile units with lockable entrances, operable windows, and serviceable finishes; heated and air conditioned; on foundations adequate for normal loading.

C. Fire Extinguishers: Hand carried, portable, UL rated. Provide class and extinguishing agent as indicated or a combination of extinguishers of NFPA-recommended classes for exposures.
   1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

D. Self-Contained Toilet Units: Single-occupant units of chemical, aerated recirculation, or combustion type; vented; fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material.

E. Drinking-Water Fixtures: Including paper cup supply.

F. Heating Equipment: Provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control. Provide proper ventilation while heaters are in use. Do not leave heaters unattended.
   1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
   2. Heating Units: Listed and labeled, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use for type of fuel being consumed.

G. Electrical Outlets: Properly configured, NEMA-polarized outlets to prevent insertion of 110- to 120-V plugs into higher-voltage outlets; equipped with ground-fault circuit interrupters, reset button, and pilot light.

H. Power Distribution System Circuits: Where permitted and overhead and exposed for surveillance, wiring circuits, not exceeding 125-V ac, 20-A rating, and lighting circuits may be nonmetallic sheathed cable.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required.

B. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

A. General: Engage appropriate local utility company to install temporary service or connect to existing service. Where utility company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with utility company recommendations.
   1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
   2. Provide adequate capacity at each stage of construction. Before temporary utility is available, provide trucked-in services.
   3. Obtain easements to bring temporary utilities to Project site where Owner's easements cannot be used for that purpose.
   4. Add provisions for work not in the Contract but served by temporary facilities if required.

B. Water Service: Use of Owner's existing water and power service facilities will be permitted, as long as facilities are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.

C. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking-water fixtures. Comply with regulations and health codes for type, number, location, operation, and maintenance of fixtures and facilities.
   1. Disposable Supplies: Provide toilet tissue, paper towels, paper cups, and similar disposable materials for each facility. Maintain adequate supply. Provide covered waste containers for disposal of used material.
   2. Toilets: Install self-contained toilet units. Shield toilets to ensure privacy.

D. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment from that specified that will not have a harmful effect on completed installations or elements being installed.

E. Retain subparagraph below if a minimum temperature in enclosed portions of building is required to forestall possibility of damage to completed construction.
   1. Maintain a minimum temperature of 50-deg F in permanently enclosed portions of building for normal construction activities, and 65-deg F for finishing activities and areas where finished work has been installed.

F. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment from that specified that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.

G. Electric Power Service: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period. Include meters, transformers, overload-protected disconnecting means, automatic ground-fault interrupters, and main distribution switchgear.

H. Electric Distribution: Provide receptacle outlets adequate for connection of power tools and equipment.
   1. Provide waterproof connectors to connect separate lengths of electrical power cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage ratio.
   2. Provide warning signs at power outlets other than 110 to 120 V.

I. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations and traffic conditions.
   1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

J. Telephone Service: Provide temporary telephone service throughout construction period for common-use facilities used by all personnel engaged in construction activities. Install separate telephone line for each field office and first-aid station.
   1. At each telephone, post a list of important telephone numbers.
      a. Police and fire departments.
      b. Ambulance service.
      c. Contractor's home office.
      d. Architect's office.
      e. Engineers' offices.
      f. Principal subcontractors' field and home offices.

3.3 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:
   1. Locate field offices, storage sheds, sanitary facilities, and other temporary construction and support facilities for easy access.

B. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Containerize and clearly label hazardous, dangerous, or unsanitary waste materials separately from other waste. Comply with Division 1 Section "Execution Requirements" for progress cleaning requirements.
   1. 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 of the structure unless otherwise approved by the authorities having jurisdiction.
   2. If required by authorities having jurisdiction, provide separate containers, clearly labeled, for each type of waste material to be deposited.

C. Common-Use Field Office: Provide an insulated, weathertight, air-conditioned field office for use as a common facility by all personnel engaged in construction activities; of sufficient size to accommodate required office personnel and meetings at Project site. Keep office clean and orderly.

D. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment involved, including temporary utility services. Sheds may be open shelters or fully enclosed spaces within building or elsewhere on-site.

E. Lifts and Hoists: Provide facilities for hoisting materials and personnel. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

F. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate. Cover finished, permanent stairs with protective covering of plywood or similar material so finishes will be undamaged at time of acceptance.

G. Project Identification and Temporary Signs: Prepare Project identification and other signs in sizes indicated on attached sheet at the end of this Section. Install additional signs as required to inform visitors of the requirements and conditions for seeking entrance to Project. Do not permit installation of unauthorized signs.
   1. Prepare temporary signs to provide directional information to construction personnel and visitors.
   2. Construct signs other than the Project Identification Sign of exterior-type Grade B-B high-density concrete form overlay plywood in sizes required for wording and 5/8-inch thicknesses. Support on posts of preservative-treated wood, fencing, or other substantial back-up weather-resistant material.
   3. Paint sign panel and applied graphics with exterior-grade alkyd gloss enamel over exterior primer.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects. Avoid using tools and equipment that produce harmful noise. Restrict use of noisemaking tools and equipment to hours that will minimize complaints from persons or firms near Project site.

B. Stormwater Control: Provide earthen embankments and similar barriers in and around excavations and subgrade construction, sufficient to prevent flooding by runoff of stormwater from heavy rains.

C. Site Enclosure Fence: Before construction operations begin, install chain-link enclosure fence with lockable entrance gates. Locate where indicated. Install in a manner that will prevent people, dogs, and other animals from easily entering site except by entrance gates.
   1. Set fence posts in in concrete bases.
   2. Provide gates in sizes and at locations necessary to accommodate delivery vehicles and other construction operations.
   3. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Provide Owner's Project Manager with one set of keys.

D. Security Enclosure and Lockup: Install substantial temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security.

E. Barricades, Warning Signs, and Lights: Comply with standards and code requirements for erecting structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and public of possible hazard. Where appropriate and needed, provide lighting, including flashing red or amber lights.

F. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.

G. Temporary Fire Protection: Until fire-protection needs are supplied by permanent facilities, install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241.
   1. Provide fire extinguishers, installed on walls on mounting brackets, visible and accessible from space being served, with sign mounted above.
      a. Field Offices: Class A stored-pressure water-type extinguishers.
      b. Other Locations: Class ABC dry-chemical extinguishers or a combination of extinguishers of NFPA-recommended classes for exposures.
      c. Locate fire extinguishers where convenient and effective for their intended purpose; provide not less than one extinguisher on each floor at or near each usable stairwell.
   2. Store combustible materials in containers in fire-safe locations.
   3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire-protection facilities, stairways, and other access routes for firefighting. Prohibit smoking in hazardous fire-exposure areas.
   4. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition.
   5. Permanent Fire Protection: At earliest feasible date in each area of Project, complete installation of permanent fire-protection facility, including connected services, and place into operation and use. Instruct key personnel on use of facilities.
   6. Develop and supervise an overall fire-prevention and first-aid fire-protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.

3.5 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage caused by freezing temperatures and similar elements.
   1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
   2. Prevent water-filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.

C. Temporary Facility Changeover: Except for using permanent fire protection as soon as available, do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
   1. Materials and facilities that constitute temporary facilities are the property of Contractor. Owner reserves right to take possession of Project identification signs.
   2. At Substantial Completion, clean and renovate permanent facilities used during construction period. Comply with final cleaning requirements in Division 1 Section "Closeout Procedures."

END OF SECTION 01500

SECTION 01575 - TEMPORARY EROSION AND SEDIMENTATION CONTROL

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Prevention of erosion due to construction activities.

B. Prevention of sedimentation of waterways, open drainage ways, and storm and sanitary sewers due to construction activities.

C. Restoration of areas eroded due to insufficient preventive measures.

D. Compensation of Owner for fines levied by authorities having jurisdiction due to non-compliance by Contractor.

1.2 RELATED REQUIREMENTS

A. Section 01355 - LEED Certification Procedures: LEED credits relating to erosion and sedimentation control.

B. Section 02230 - Site Clearing: Limits on clearing; disposition of vegetative clearing debris.

C. Section 02310 - Grading: Temporary and permanent grade changes for erosion control.

D. Section 02373 - Riprap: Temporary and permanent stabilization using riprap.

E. Section 02721 - Aggregate Base Course: Temporary and permanent roadways.

F. Section 03300 - Cast-in-Place Concrete: Concrete for temporary and permanent erosion control structures indicated on drawings.

1.3 REFERENCE STANDARDS

A. ASTM D 4355 - Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture, and Heat in a Xenon Arc Type Apparatus; 2007.

B. ASTM D 4491 - Standard Test Methods for Water Permeability of Geotextiles by Permittivity; 1999a (Reapproved 2009).

C. ASTM D 4533 - Standard Test Method for Trapezoid Tearing Strength of Geotextiles; 2004 (Reapproved 2009).

D. ASTM D 4632 - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles; 2008.

E. ASTM D 4751 - Standard Test Method for Determining Apparent Opening Size of a Geotextile; 2004.

F. ASTM D 4873 - Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples; 2002 (Reapproved 2009).

G. EPA (NPDES) - National Pollutant Discharge Elimination System (NPDES), Construction General Permit; current edition.

1.4 PERFORMANCE REQUIREMENTS

A. Comply with all requirements of U.S. Environmental Protection Agency for erosion and sedimentation control, as specified for the National Pollutant Discharge Elimination System (NPDES), Phases I and II, under requirements for the 2003 Construction General Permit (CGP).

B. Also comply with all more stringent requirements of State of Alabama Erosion and Sedimentation Control Manual.

C. Develop and follow an Erosion and Sedimentation Prevention Plan and submit periodic inspection reports.

D. Do not begin clearing, grading, or other work involving disturbance of ground surface cover until applicable permits have been obtained; furnish all documentation required to obtain applicable permits.
   1. Obtain and pay for permits and provide security required by authority having jurisdiction.

E. Timing: Put preventive measures in place as soon as possible after disturbance of surface cover and before precipitation occurs.

F. Storm Water Runoff: Control increased storm water runoff due to disturbance of surface cover due to construction activities for this project.
   1. Prevent runoff into storm and sanitary sewer systems, including open drainage channels, in excess of actual capacity or amount allowed by authorities having jurisdiction, whichever is less.
   2. Anticipate runoff volume due to the most extreme short term and 24-hour rainfall events that might occur in 25 years.

G. Erosion On Site: Minimize wind, water, and vehicular erosion of soil on project site due to construction activities for this project.
   1. Control movement of sediment and soil from temporary stockpiles of soil.
   2. Prevent development of ruts due to equipment and vehicular traffic.
   3. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to Owner.

H. Open Water: Prevent standing water that could become stagnant.

I. Maintenance: Maintain temporary preventive measures until permanent measures have been established.

1.5 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. LEED Submittals: Submit all submittals required in this section in accordance with procedures specified in Section 01355.

C. Erosion and Sedimentation Control Plan:
   1. Include:
      a. Site plan identifying soils and vegetation, existing erosion problems, and areas vulnerable to erosion due to topography, soils, vegetation, or drainage.
      b. Site plan showing grading; new improvements; temporary roads, traffic accesses, and other temporary construction; and proposed preventive measures.
      c. Where extensive areas of soil will be disturbed, include storm water flow and volume calculations, soil loss predictions, and proposed preventive measures.
      d. Schedule of temporary preventive measures, in relation to ground disturbing activities.
      e. Other information required by law.
      f. Format required by law is acceptable, provided any additional information specified is also included.
   2. Obtain the approval of the Plan by authorities having jurisdiction.
   3. Obtain the approval of the Plan by Owner.

D.

E. Certificate: Mill certificate for silt fence fabric attesting that fabric and factory seams comply with specified requirements, signed by legally authorized official of manufacturer; indicate actual minimum average roll values; identify fabric by roll identification numbers.

F.

G. Inspection Reports: Submit report of each inspection; identify each preventive measure, indicate condition, and specify maintenance or repair required and accomplished.

PART 2 PRODUCTS

2.1 MATERIALS

A. Mulch: Use one of the following:
   1. Straw or hay.
   2. Erosion control matting or netting.

B. Grass Seed For Temporary Cover: Select a species appropriate to climate, planting season, and intended purpose. If same area will later be planted with permanent vegetation, do not use species known to be excessively competitive or prone to volunteer in subsequent seasons.

C. Bales: Air dry, rectangular straw bales.
   1. Cross Section: 14 by 18 inches, minimum.
   2. Bindings: Wire or string, around long dimension.

D. Bale Stakes: One of the following, minimum 3 feet long:
   1. Steel U- or T-section, with minimum mass of 1.33 lb per linear foot.
   2. Wood, 2 by 2 inches in cross section.

E. Silt Fence Fabric: Polypropylene geotextile resistant to common soil chemicals, mildew, and insects; non-biodegradable; in longest lengths possible; fabric including seams with the following minimum average roll lengths:
   1. Average Opening Size: 30 U.S. Std. Sieve, maximum, when tested in accordance with ASTM D 4751.
   2. Permittivity: 0.05 sec^-1, minimum, when tested in accordance with ASTM D 4491.
   3. Ultraviolet Resistance: Retaining at least 70 percent of tensile strength, when tested in accordance with ASTM D 4355 after 500 hours' exposure.

4. Tensile Strength: 100 lb-f, minimum, in cross-machine direction; 124 lb-f, minimum, in machine direction; when tested in accordance with ASTM D 4632.
5. Elongation: 15 to 30 percent, when tested in accordance with ASTM D 4632.
6. Tear Strength: 55 lb-f, minimum, when tested in accordance with ASTM D 4533.
7. Color: Manufacturer's standard, with embedment and fastener lines preprinted.
8. Manufacturers:
   a. TenCate: www.tencate.com.
   b. North American Green: www.nagreen.com.
   c. Propex Geosynthetics: www.geotextile.com

F. Silt Fence Posts: One of the following, minimum 5 feet long:
1. Steel U- or T-section, with minimum mass of 1.33 lb per linear foot.
2. Hardwood, 2 by 2 inches in cross section.

G. Gravel: See Section 02721 for aggregate.

H. Riprap: See Section 02373.

I. Concrete: See Section 03300.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine site and identify existing features that contribute to erosion resistance; maintain such existing features to greatest extent possible.

3.2 PREPARATION

A. Schedule work so that soil surfaces are left exposed for the minimum amount of time.

3.3 SCOPE OF PREVENTIVE MEASURES

A. In all cases, if permanent erosion resistant measures have been installed temporary preventive measures are not required.

B. Construction Entrances: Traffic-bearing aggregate surface.
1. Width: As required; 20 feet, minimum.
2. Length: 50 feet, minimum.
3. Provide at each construction entrance from public right-of-way.
4. Where necessary to prevent tracking of mud onto right-of-way, provide wheel washing area out of direct traffic lane, with drain into sediment trap or basin.

C. Linear Sediment Barriers: Made of silt fences.
1. Provide linear sediment barriers:
   a. Along downhill perimeter edge of disturbed areas, including soil stockpiles.

2. Space sediment barriers with the following maximum slope length upslope from barrier:
   a. Slope of Less Than 2 Percent: 100 feet.
   b. Slope Between 2 and 5 Percent: 75 feet.
   c. Slope Between 5 and 10 Percent: 50 feet.
   d. Slope Between 10 and 20 Percent: 25 feet.
   e. Slope Over 20 Percent: 15 feet.

D. Storm Drain Curb Inlet Sediment Trap: Protect each curb inlet using one of the following measures:
   1. Filter fabric wrapped around hollow concrete blocks blocking entire inlet face area; use one piece of fabric wrapped at least 1-1/2 times around concrete blocks and secured to prevent dislodging; orient cores of blocks so runoff passes into inlet.
   2. Straw bale row blocking entire inlet face area; anchor into pavement.

E. Storm Drain Drop Inlet Sediment Traps: As detailed on drawings.

F. Temporary Splash Pads: Stone aggregate over filter fabric; size to suit application; provide at downspout outlets and storm water outlets.

G. Soil Stockpiles: Protect using one of the following measures:
   1. Cover with polyethylene film, secured by placing soil on outer edges.
   2. Cover with mulch at least 4-inch thickness of pine needles, sawdust, bark, wood chips, or shredded leaves, or 6 inches of straw or hay.

H. Mulching: Use only for areas that may be subjected to erosion for less than 6 months.

I. Temporary Seeding: Use where temporary vegetated cover is required.

3.4 INSTALLATION

A. Traffic-Bearing Aggregate Surface:
   1. Excavate minimum of 6 inches.
   2. Place geotextile fabric full width and length, with minimum 12 inch overlap at joints.
   3. Place and compact at least 6 inches of 1.5 to 3.5-inch diameter stone.

B. Silt Fences:
   1. Store and handle fabric in accordance with ASTM D 4873.
   2. Where slope gradient is less than 3:1 or barriers will be in place less than 6 months, use nominal 16-inch high barriers with minimum 36-inch long posts spaced at 6 feet maximum, with fabric embedded at least 4 inches in ground.
   3. Where slope gradient is steeper than 3:1 or barriers will be in place over 6 months, use nominal 28-inch high barriers, minimum 48-inch long posts spaced at 6 feet maximum, with fabric embedded at least 6 inches in ground.
   4. Where slope gradient is steeper than 3:1 and vertical height of slope between barriers is more than 20 feet, use nominal 32-inch high barriers with woven wire reinforcement and steel posts spaced at 4 feet maximum, with fabric embedded at least 6 inches in ground.
   5. Install with top of fabric at nominal height and embedment as specified.
   6. Do not splice fabric width; minimize splices in fabric length; splice at post only, overlapping at least 18 inches, with extra post.

7. Fasten fabric to wood posts using one of the following:
   a. Four 3/4-inch diameter, 1 inch long, 14 gage nails.
   b. Five 17-gage staples with 3/4-inch wide crown and 1/2-inch legs.
8. Fasten fabric to steel posts using wire, nylon cord, or integral pockets.
9. Wherever runoff will flow around end of barrier or over the top, provide temporary splash pad or other outlet protection; at such outlets in the run of the barrier, make barrier not more than 12 inches high with post spacing not more than 4-feet.

C. Straw Bale Rows:
1. Install bales in continuous rows with ends butting tightly, with one bale at each end of row turned uphill.
2. Install bales so that bindings are not in contact with the ground.
3. Embed bales at least 4 inches in the ground.
4. Anchor bales with at least two stakes per bale, driven at least 18 inches into the ground; drive first stake in each bale toward the previously placed bale to force bales together.
5. Fill gaps between ends of bales with loose straw wedged tightly.
6. Place soil excavated for trench against bales on the upslope side of the row, compacted.

D. Temporary Seeding:
1. When hydraulic seeder is used, seedbed preparation is not required.
2. When surface soil has been sealed by rainfall or consists of smooth undisturbed cut slopes, and conventional or manual seeding is to be used, prepare seedbed by scarifying sufficiently to allow seed to lodge and germinate.
3. If temporary mulching was used on planting area but not removed, apply nitrogen fertilizer at 1 pound per 1000 sq ft.
4. On soils of very low fertility, apply 10-10-10 fertilizer at rate of 12 to 16 pounds per 1000 sq ft.
5. Incorporate fertilizer into soil before seeding.
6. Apply seed uniformly; if using drill or cultipacker seeders place seed 1/2- to 1-inch deep.
7. Irrigate as required to thoroughly wet soil to depth that will ensure germination, without causing runoff or erosion.
8. Repeat irrigation as required until grass is established.

3.5 MAINTENANCE

A. Inspect preventive measures weekly, within 24 hours after the end of any storm that produces 0.5 inches or more rainfall at the project site, and daily during prolonged rainfall.

B. Repair deficiencies immediately.

C. Silt Fences:
1. Promptly replace fabric that deteriorates unless need for fence has passed.
2. Remove silt deposits that exceed one-third of the height of the fence.
3. Repair fences that are undercut by runoff or otherwise damaged, whether by runoff or other causes.

D. Straw Bale Rows:
1. Promptly replace bales that fall apart or otherwise deteriorate unless need has passed.
2. Remove silt deposits that exceed one-half of the height of the bales.
3. Repair bale rows that are undercut by runoff or otherwise damaged, whether by runoff or other causes.

E. Clean out temporary sediment control structures weekly and relocate soil on site.

F. Place sediment in appropriate locations on site; do not remove from site.

3.6 CLEAN UP

A. Remove temporary measures after permanent measures have been installed, unless permitted to remain by Architect.

B. Clean out temporary sediment control structures that are to remain as permanent measures.

C. Where removal of temporary measures would leave exposed soil, shape surface to an acceptable grade and finish to match adjacent ground surfaces.

END OF SECTION 01575

SECTION 01600 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. General product requirements.

B. Transportation, handling, storage and protection.

C. Product option requirements.

D. Substitution limitations and procedures.

E. Maintenance materials, including extra materials, spare parts, tools, and software.

1.2 RELATED REQUIREMENTS

A. Section 01400 - Quality Requirements: Product quality monitoring.

B. Section 01616 - Volatile Organic Compound (VOC) Content Restrictions: Requirements for VOC-restricted product categories.

1.3 REFERENCE STANDARDS

A. 16 CFR 260 - Guides for the Use of Environmental Marketing Claims; Federal Trade Commission; current edition.

B. CAN/CSA Z809 - National Standard for Sustainable Forest Management; CSA International Inc.; 2002 (R2007).

C. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.4 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

2.1 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 outside the United States, its territories, Canada, or Mexico.
   2. Made using or containing CFC's or HCFC's.
   3. Made of wood from newly cut old growth timber.

C. Where all other criteria are met, Contractor shall give preference to products that:
   1. Are extracted, harvested, and/or manufactured closer to the location of the project.
   2. Have longer documented life span under normal use.
   3. Result in less construction waste.
   4. Are made of vegetable materials that are rapidly renewable.

D. Products with Recycled Content:
   1. Specific Product Categories: Provide recycled content as specified elsewhere.

2.2 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.

2.3 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

3.1 SUBSTITUTION PROCEDURES

A. Instructions to Bidders specify time restrictions for submitting requests for substitutions during the bidding period. Comply with requirements specified in this section.

B. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.

C. 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. Will provide the same warranty for the substitution as for the specified product.
   3. Will coordinate installation and make changes to other Work that may be required for the Work to be complete with no additional cost to Owner.
   4. Waives claims for additional costs or time extension that may subsequently become apparent.

D. Substitution Submittal Procedure:
   1. Submit three 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.

3.2 TRANSPORTATION AND HANDLING

A. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.

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

C. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.

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

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

F. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

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

G. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

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

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 01600

SECTION 01616 - VOLATILE ORGANIC COMPOUND (VOC) CONTENT RESTRICTIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. VOC restrictions for product categories listed below under "DEFINITIONS."

B. All products of each category that are installed in the project must comply; Owner's project goals do not allow for partial compliance.

1.2 DEFINITIONS

A. VOC-Restricted Products: All products of each of the following categories when installed or applied on-site in the building interior:
   1. Adhesives, sealants, and sealer coatings.
   2. Carpet.
   3. Carpet cushion.
   4. Carpet tile.
   5. Resilient floor coverings.
   6. Paints and coatings.
   7. Insulation.
   8. Gypsum board.
   9. Acoustical ceilings and panels.
   10. Cabinet work.
   11. Composite wood and agrifiber products used either alone or as part of another product.

B. Interior of Building: Anywhere inside the exterior weather barrier.

C. Adhesives: All gunnable, trowelable, liquid-applied, and aerosol adhesives, whether specified or not; including flooring adhesives, resilient base adhesives, and pipe jointing adhesives.

D. Sealants: All gunnable, trowelable, and liquid-applied joint sealants and sealant primers, whether specified or not; including firestopping sealants and duct joint sealers.

1.3 REFERENCE STANDARDS

A. CAL (CHPS LEM) - Low-Emitting Materials Product List; California Collaborative for High Performance Schools (CHPS); current edition at www.chps.net/.

B. CAL (VOC) - Standard Practice for the Testing of Volatile Organic Emissions From Various Sources Using Small-Scale Environmental Chambers (including Addendum 2004-01); State of California Department of Health Services; 2004.

C. CRI (GLCC) - Green Label Testing Program - Approved Product Categories for Carpet Cushion; Carpet and Rug Institute; Current Edition.

D. CRI (GLP) - Green Label Plus Carpet Testing Program - Approved Products; Carpet and Rug Institute; Current Edition.

E. GEI (SCH) - GREENGUARD "Children and Schools" Certified Products; GREENGUARD

Environmental Institute; current listings at www.greenguard.org.

F. GreenSeal GS-36 - Commercial Adhesives; Green Seal, Inc.; 2000.

G. SCAQMD 1168 - South Coast Air Quality Management District Rule No.1168; current edition; www.aqmd.gov.

H. SCS (CPD) - SCS Certified Products; Scientific Certification Systems; current listings at www.scscertified.com.

1.4 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Evidence of Compliance: Submit for each different product in each applicable category.

C. Product Data: For each VOC-restricted product used in the project, submit product data showing compliance, except when another type of evidence of compliance is required.

D. Installer Certifications for Accessory Materials: Require each installer of any type of product (not just the products for which VOC restrictions are specified) to certify that either 1) no adhesives, joint sealants, paints, coatings, or composite wood or agrifiber products have been used in the installation of his products, or 2) that such products used comply with these requirements.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

PART 2 PRODUCTS

2.1 MATERIALS

A. All VOC-Restricted Products: Provide products having VOC content of types and volume not greater than those specified in State of California Department of Health Services Standard Practice for the Testing of Volatile Organic Emissions From Various Sources Using Small-Scale Environmental Chambers.

1. Evidence of Compliance: Acceptable types of evidence are:
    a. Current GREENGUARD Children & Schools certification; www.greenguard.org.
    b. Current Carpet and Rug Institute Green Label Plus certification; www.carpet-rug.org.
    c. Current SCS Floorscore certification; www.scscertified.com.
    d. Current SCS Indoor Advantage Gold certification; www.scscertified.com.
    e. Product listing in the CHPS Low-Emitting Materials Product List at www.chps.net/manual/lem_table.htm.
    f. Current certification by any other agencies acceptable to CHPS.
    g. Report of laboratory testing performed in accordance with CHPS requirements for getting a product listed in the Low-Emitting Materials Product List; report must include laboratory's statement that the product meets the specified criteria.
2. Product data submittals showing VOC content are NOT acceptable forms of evidence.

B. Adhesives and Joint Sealants: Provide only products having volatile organic compound (VOC) content not greater than required by South Coast Air Quality Management District Rule No.1168.
   1. Evidence of Compliance: Acceptable types of evidence are:
      a. Report of laboratory testing performed in accordance with requirements.

C. Aerosol Adhesives: Provide only products having volatile organic compound (VOC) content not greater than required by GreenSeal GS-36.
   1. Evidence of Compliance: Acceptable types of evidence are:
      a. Current GreenSeal Certification.

D. Paints and Coatings:
   1. Provide coatings that comply with the most stringent requirements specified in the following:
      a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
      b. Ozone Transport Commission (OTC) Model Rule, Architectural, Industrial, and Maintenance Coatings; www.otcair.org; specifically:
         1) Opaque, Flat: 50 g/L, maximum.
         2) Opaque, Nonflat: 150 g/L, maximum.
         3) Opaque, High Gloss: 250 g/L, maximum.
         4) Varnishes: 350 g/L, maximum.
   2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.
   3. Evidence of Compliance: Acceptable types of evidence are:
      a. Report of laboratory testing performed in accordance with requirements.

E. Carpet and Adhesive: Provide products having VOC content not greater than that required for CRI Green Label Plus certification.
   1. Evidence of Compliance: Acceptable types of evidence are:
      a. Current Green Label Plus Certification.
      b. Report of laboratory testing performed in accordance with requirements.

F. Carpet Cushion: Provide products having VOC content not greater than that required for CRI Green Label certification.
   1. Evidence of Compliance: Acceptable types of evidence are:
      a. Current Green Label Certification.
      b. Report of laboratory testing performed in accordance with requirements.

G. Carpet Tile and Adhesive: Provide products having VOC content not greater than that required for CRI Green Label Plus certification.
   1. Evidence of Compliance: Acceptable types of evidence are:
      a. Current Green Label Plus Certification.
      b. Report of laboratory testing performed in accordance with requirements.

H. Carpet Tile and Adhesive: Provide products having VOC content as specified in Section 09685.

I. Composite Wood and Agrifiber Products and Adhesives Used for Laminating Them: Provide products having no added urea-formaldehyde resins.
   1. Evidence of Compliance: Acceptable types of evidence are:
      a. Published product data showing compliance with requirements.

PART 3 EXECUTION

3.1 FIELD QUALITY CONTROL

A. Owner reserves the right to reject non-compliant products, whether installed or not, and require their removal and replacement with compliant products at no extra cost to Owner.

B. All additional costs to restore indoor air quality due to installation of non-compliant products will be borne by Contractor.

END OF SECTION 01616

SECTION 01700 - EXECUTION REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Examination, preparation, and general installation procedures.

B. Pre-installation meetings.

C. Surveying for laying out the work.

D. Cleaning and protection.

E. Starting of systems and equipment.

F. Demonstration and instruction of Owner personnel.

G. Closeout procedures, except payment procedures.

H. General requirements for maintenance service.

1.2 RELATED REQUIREMENTS

A. Section 01100 - Summary: Limitations on working in existing building; continued occupancy; work sequence; identification of salvaged and relocated materials.

B. Section 01300 - Administrative Requirements: Submittals procedures.

C. Section 01400 - Quality Requirements: Testing and inspection procedures.

D. Section 01500 - Temporary Facilities and Controls: Temporary exterior enclosures.

E. Section 01575 - Temporary Erosion and Sedimentation Control: Additional erosion and sedimentation control requirements.

F. Section 01732 - Waste Management: Additional procedures for trash/waste removal, recycling, salvage, and reuse.

G. Section 01780 - Closeout Submittals: Project record documents, operation and maintenance data, warranties and bonds.

H. Section 01810 - Commissioning: Contractor's responsibilities in regard to commissioning.

I. Section 07840 - Firestopping.

1.3 REFERENCE STANDARDS

A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2009.

1.4 SUBMITTALS

A. See Section 01300 - 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.

1.5 QUALIFICATIONS

A. For survey work, employ a land surveyor registered in Alabama and acceptable to Architect. Submit evidence of Surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate.

B. For field engineering, employ a professional engineer of the discipline required for specific service on Project, licensed in Alabama.

1.6 PROJECT CONDITIONS

A. Use of explosives is not permitted.

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

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

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

E. 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.

F. 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.

G. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.
   1. Outdoors: Limit conduct of especially noisy exterior work to 5 to 8 AM and 5 to 8 PM.

H. Pest and Rodent Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work.

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

1.7 COORDINATION

A. See Section 01100 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

2.1 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 01600.

PART 3 - EXECUTION

3.1 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.

3.2 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.

3.3 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.

3.4 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.
   2. Grid or axis for structures.
   3. Building foundation, column locations, ground floor elevations.

H. Periodically verify layouts by same means.

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

3.5 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.

3.6 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.

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

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

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

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

H. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07840, 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.

3.7 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.

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

3.9 SYSTEM STARTUP

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

B. 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.

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

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

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

F. 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.

G. 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.

G. The amount of time required for instruction on each item of equipment and system is that specified in individual sections.

3.11 ADJUSTING

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

B. Testing, adjusting, and balancing HVAC systems: See Section 15950.

3.12 FINAL CLEANING

A. Execute final cleaning prior to final project assessment.

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, 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 Contractor's Notice of Substantial Completion.

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

D. Submit written certification that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's review.

E. Owner will occupy all of the building as specified in Section 01100.

F. Correct items of work listed in executed Certificates of Substantial Completion and comply with requirements for access to Owner-occupied areas.

G. Accompany Project Coordinator on preliminary final inspection.

H. Notify Architect when work is considered finally complete.

I. Complete items of work determined by Architect's final inspection.

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 01700

SECTION 01732 - WASTE MANAGEMENT

PART 1 GENERAL

1.1 WASTE MANAGEMENT REQUIREMENTS

A. Owner requires that this project generate the least amount of trash and waste possible.

B. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.

C. Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.

D. Required Recycling, Salvage, and Reuse: The following may not be disposed of in landfills or by incineration:
   1. Aluminum and plastic beverage containers.
   2. Corrugated cardboard.
   3. Wood pallets.
   4. Clean dimensional wood: May be used as blocking or furring.
   5. Land clearing debris, including brush, branches, logs, and stumps: See Section 02230 for use options.
   6. Metals, including packaging banding, metal studs, sheet metal, structural steel, piping, reinforcing bars, door frames, and other items made of steel, iron, galvanized steel, stainless steel, aluminum, copper, zinc, lead, brass, and bronze.
   7. Carpet, carpet cushion, carpet tile, and carpet remnants, both new and removed: DuPont (http://flooring.dupont.com) and Interface (www.interfaceinc.com) conduct reclamation programs.

E. Diversion of 50 percent, by weight, of potential landfill trash/waste by recycling and/or salvage is required.

F. Contractor shall submit periodic Waste Disposal Reports; all landfill disposal, incineration, recycling, salvage, and reuse must be reported regardless of to whom the cost or savings accrues; use the same units of measure on all reports.

G. Contractor shall develop and follow a Waste Management Plan designed to implement these requirements.

H. Methods of trash/waste disposal that are not acceptable are:
   1. Burning on the project site.
   2. Burying on the project site.
   3. Dumping or burying on other property, public or private.
   4. Other illegal dumping or burying.

I. Regulatory Requirements: Contractor is responsible for knowing and complying with regulatory requirements, including but not limited to Federal, state and local requirements, pertaining to legal disposal of all construction and demolition waste materials.

1.2 RELATED REQUIREMENTS

A. Section 01300 - Administrative Requirements: Additional requirements for project meetings, reports, submittal procedures, and project documentation.
B. Section 01500 - Temporary Facilities and Controls: Additional requirements related to trash/waste collection and removal facilities and services.
C.
D. Section 01600 - Product Requirements: Waste prevention requirements related to delivery, storage, and handling.
E.
F. Section 01700 - Execution Requirements: Trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.
G.
H. Section 02230 - Site Clearing: Handling and disposal of land clearing debris.

1.3 DEFINITIONS

A. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.

B. Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, remodeling, repair and demolition operations.

C. Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity or reactivity.

D. Nonhazardous: Exhibiting none of the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity, or reactivity.

E. Nontoxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.

F. Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.

G. Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.

H. Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.

I. Return: To give back reusable items or unused products to vendors for credit.

J. Reuse: To reuse a construction waste material in some manner on the project site.

K. Salvage: To remove a waste material from the project site to another site for resale or reuse by others.

L. Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.

M. Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.

N. Toxic: Poisonous to humans either immediately or after a long period of exposure.

O. Trash: Any product or material unable to be reused, returned, recycled, or salvaged.

P. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

1.4 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Waste Management Plan: Include the following information:
1. Analysis of the trash and waste projected to be generated during the entire project construction cycle, including types and quantities.
2. Landfill Options: The name, address, and telephone number of the landfill(s) where trash/waste will be disposed of, the applicable landfill tipping fee(s), and the projected cost of disposing of all project trash/waste in the landfill(s).
3. Landfill Alternatives: List all waste materials that will be diverted from landfills by reuse, salvage, or recycling.
4. Meetings: Describe regular meetings to be held to address waste prevention, reduction, recycling, salvage, reuse, and disposal.
5. Materials Handling Procedures: Describe the means by which materials to be diverted from landfills will be protected from contamination and prepared for acceptance by designated facilities; include separation procedures for recyclables, storage, and packaging.
6. Transportation: Identify the destination and means of transportation of materials to be recycled; i.e. whether materials will be site-separated and self-hauled to designated centers, or whether mixed materials will be collected by a waste hauler.

PART 2 - PRODUCTS

2.1 PRODUCT SUBSTITUTIONS

A. See Section 01600 - Product Requirements for substitution submission procedures.

B. For each proposed product substitution, submit the following information in addition to requirements specified in Section 01600:
1. Relative amount of waste produced, compared to specified product.
2. Cost savings on waste disposal, compared to specified product, to be deducted from the Contract Price.
3. Proposed disposal method for waste product.
4. Markets for recycled waste product. PART 3 - EXECUTION

3.1 WASTE MANAGEMENT PROCEDURES

A. See Section 01300 for additional requirements for project meetings, reports, submittal procedures, and project documentation.

B. See Section 01500 for additional requirements related to trash/waste collection and removal facilities and services.

C. See Section 01600 for waste prevention requirements related to delivery, storage, and handling.

D. See Section 01700 for trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

3.2 WASTE MANAGEMENT PLAN IMPLEMENTATION

A. Manager: Designate an on-site person or persons responsible for instructing workers and overseeing and documenting results of the Waste Management Plan.

B. Communication: Distribute copies of the Waste Management Plan to job site foreman, each subcontractor, Owner, and Architect.

C. Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project.

D. Meetings: Discuss trash/waste management goals and issues at project meetings.
1. Pre-bid meeting.
2. Pre-construction meeting.
3. Regular job-site meetings.

E. Facilities: Provide specific facilities for separation and storage of materials for recycling, salvage, reuse, return, and trash disposal, for use by all contractors and installers.
1. Provide containers as required.
2. Provide adequate space for pick-up and delivery and convenience to subcontractors.
3. Keep recycling and trash/waste bin areas neat and clean and clearly marked in order to avoid contamination of materials.

F. Hazardous Wastes: Separate, store, and dispose of hazardous wastes according to applicable regulations.

G. Recycling: Separate, store, protect, and handle at the site identified recyclable waste products in order to prevent contamination of materials and to maximize recyclability of identified materials. Arrange for timely pickups from the site or deliveries to recycling facility in order to prevent contamination of recyclable materials.

H. Reuse of Materials On-Site: Set aside, sort, and protect separated products in preparation for reuse.

I. Salvage: Set aside, sort, and protect products to be salvaged for reuse off-site.

END OF SECTION 01732

SECTION 01734 - INDOOR AIR QUALITY

PART 1 GENERAL

1.1 SECTION INCLUDES

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

B. Building flush-out after construction and before occupancy.

C. Testing indoor air quality after completion of construction.

1.2 PROJECT GOALS

A. Dust and Airborne Particulates: Prevent deposition of dust and other particulates in HVAC ducts and equipment.
   1. Contractor shall bear the cost of cleaning required due to failure to protect ducts and equipment from construction dust.
   2. Establish condition of existing ducts and equipment prior to start of alterations.

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

C. Ventilation: HVAC system has been designed to achieve the minimum requirements for ventilation specified in ASHRAE 62.1.

1.3 RELATED REQUIREMENTS

A. Section 01400 - Quality Requirements: Testing and inspection services.

B. Section 01616 - Volatile Organic Compound (VOC) Content Restrictions.

C. Section 15950 - Testing, Adjusting, and Balancing: Testing HVAC systems for proper air flow rates, adjustment of dampers and registers, and settings for equipment.

1.4 REFERENCE STANDARDS

A. ASHRAE Std 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size; 2007.

B. ASHRAE Std 62.1 - Ventilation For Acceptable Indoor Air Quality; 2010.

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

1.5 DEFINITIONS

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

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

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

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

1.6 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

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

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

D. Duct and Terminal Unit Inspection Report.

E. Air Contaminant Test Plan: Identify:
   1. Testing agency qualifications.
   2. Locations and scheduling of air sampling.
   3. Test procedures, in detail.
   4. Test instruments and apparatus.
   5. Sampling methods.

F. Air Contaminant Test Reports: Show:
   1. Location where each sample was taken, and time.
   2. Test values for each air sample; average the values of each set of 3.
   3. HVAC operating conditions.
   4. Certification of test equipment calibration.
   5. Other conditions or discrepancies that might have influenced results.

G. Ventilation Effectiveness Test Plan: Identify:
   1. Testing agency qualifications.
   2. Description of test spaces, including locations of air sampling.
   3. Test procedures, in detail; state whether tracer gas decay or step-up will be used.
   4. Test instruments and apparatus; identify tracer gas to be used.
   5. Sampling methods.

H. Ventilation Effectiveness Test Reports: Show:
   1. Include preliminary tests of instruments and apparatus and of test spaces.
   2. Calculation of ventilation effectiveness, E.
   3. Location where each sample was taken, and time.
   4. Test values for each air sample.
   5. HVAC operating conditions.
   6. Other information specified in ASHRAE 129.
   7. Other conditions or discrepancies that might have influenced results.

1.7 QUALITY ASSURANCE

A. Testing and Inspection Agency Qualifications: Independent testing agency having minimum of 5 years' experience in performing the types of testing specified.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Low VOC Materials: See other sections for specific requirements for materials with low VOC content.

B. Auxiliary Air Filters: MERV of 8, minimum, when tested in accordance with ASHRAE 52.2.

PART 3 - EXECUTION

3.1 CONSTRUCTION PROCEDURES

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

B. Begin construction ventilation when building is substantially enclosed.

C. If extremely dusty or dirty work must be conducted inside the building, shut down HVAC systems for the duration; remove dust and dirt completely before restarting systems.

D. When working in a portion of an occupied building, prevent movement of air from construction area to occupied area.

E. HVAC equipment and supply air ductwork may be used for ventilation during construction:
   1. Operate HVAC system on 100 percent outside air, with 1.5 air changes per hour, minimum.
   2. Ensure that air filters are correctly installed prior to starting use; replace filters when they lose efficiency.

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

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

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

I. Use other relevant recommendations of SMACNA IAQ Guideline for Occupied Buildings Under Construction for avoiding unnecessary contamination due to construction procedures.

3.2 BUILDING FLUSH-OUT

A. Contractor's Option: Either full continuous flush-out OR satisfactory air contaminant testing is required, not both.

B. Perform building flush-out before occupancy.

C. Do not start flush-out until:
   1. All construction is complete.
   2. HVAC systems have been tested, adjusted, and balanced for proper operation.
   3. Inspection of inside of return air ducts and terminal units confirms that cleaning is not necessary.
   4. New HVAC filtration media have been installed.

D. Building Flush-Out: Operate all ventilation systems at normal flow rates with 100 percent outside air until a total air volume of 14,000 cubic feet per square foot of floor area has been supplied.
   1. Obtain Owner's concurrence that construction is complete enough before beginning flush- out.
   2. Maintain interior temperature of at least 60 degrees F and interior relative humidity no higher than 60 percent.
   3. If additional construction involving materials that produce particulates or any of the specified contaminants is conducted during flush-out, start flush-out over.
   4. If interior spaces must be occupied prior to completion of the flush-out, supply a minimum of 25 percent of the total air volume prior to occupancy, and:
      a. Begin ventilation at least three hours prior to daily occupancy.
      b. Continue ventilation during all occupied periods.
      c. Provide minimum outside air volume of 0.30 cfm per square foot or design minimum outside air rate, whichever is greater.

E. Install new HVAC filtration media after completion of flush-out and before occupancy or further testing.

3.3 AIR CONTAMINANT TESTING

A. Contractor's Option: Either full continuous flush-out OR satisfactory air contaminant testing is required, not both.

B. Perform air contaminant testing before starting construction, as base line for evaluation of post- construction testing.

C. Perform air contaminant testing before occupancy.

D. Do not start air contaminant testing until:
   1. All construction is complete, including interior finishes.
   2. HVAC systems have been tested, adjusted, and balanced for proper operation.
   3. New HVAC filtration media have been installed.

E. Indoor Air Samples: Collect from spaces representative of occupied areas:
   1. Collect samples while operable windows and exterior doors are closed, HVAC system is running normally as if occupied, with design minimum outdoor air, but with the building unoccupied.
   2. Collect samples from spaces in each contiguous floor area in each air handler zone, but not less than one sample per 25,000 square feet; take samples from areas having the least ventilation and those having the greatest presumed source strength.
   3. Collect samples from height from 36 inches to 72 inches above floor.
   4. Collect samples from same locations on 3 consecutive days during normal business hours; average the results of each set of 3 samples.
   5. Exception: Areas with normal very high outside air ventilation rates, such as laboratories, do not need to be tested.
   6. When retesting the same building areas, take samples from at least the same locations as in first test.

F. Outdoor Air Samples: Collect samples at outside air intake of each air handler at the same time as indoor samples are taken.

G. Analyze air samples and submit report.

H. Air Contaminant Concentration Determination and Limits:
   1. Carbon Monoxide: Not more than 9 parts per million and not more than 2 parts per million higher than outdoor air.
   2. Airborne Mold and Mildew: Measure in relation to outside air; not higher than outside air.
   3. Formaldehyde: Not more than 50 parts per billion.
   4. Formaldehyde: Measure in micrograms per cubic meter, in relation to outside air; not more than 20 micrograms per cubic meter higher than outside air.
   5. Total Volatile Organic Compounds (TVOC): Not more than 500 micrograms per cubic meter.
   6. Total Volatile Organic Compounds (TVOC): Measure in micrograms per cubic meter, in relation to outside air; not more than 200 micrograms per cubic meter higher than outside air.
   7. Particulates (PM10): Not more than 50 micrograms per cubic meter.
   8. Total Particulates (PM): Measure in micrograms per cubic meter, in relation to outside air; not more than 20 micrograms per cubic meter higher than outside air.

I. If air samples show concentrations higher than those specified, ventilate with 100 percent outside air and retest at no cost to Owner, or conduct full building flush-out specified above.

END OF SECTION 01734

SECTION 01780 - CLOSEOUT SUBMITTALS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Project Record Documents.

B. Operation and Maintenance Data.

C. Warranties and bonds.

1.2 RELATED REQUIREMENTS

A. General Conditions: Performance bond and labor and material payment bonds, warranty, and correction of work.

B. Section 01300 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.

C. Section 01700 - Execution Requirements: Contract closeout procedures.

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

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

1.3 SUBMITTALS

A. Project Record Documents: Submit documents to Architect.

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

3.1 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. Changes made by Addenda and modifications.

F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
   1. Field changes of dimension and detail.
   2. Details not on original Contract drawings.

3.2 OPERATION AND MAINTENANCE DATA

A. 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.

3.3 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

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

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

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

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

E. Provide a listing in Table of Contents for design data, with tabbed fly sheet and space for insertion of data.

3.4 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. 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.

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

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

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

F. Include sequence of operation by controls manufacturer.

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

H. Provide control diagrams by controls manufacturer as installed.

I. Provide Contractor's coordination drawings, with color coded piping diagrams as installed.

J. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

K. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

L. Include test and balancing reports.

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

3.5 OPERATION AND MAINTENANCE MANUALS

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

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

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

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

E. Provide tabbed dividers for each separate product and system, with typed description of product and major component parts of equipment.

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

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

H. Arrange content by systems under section numbers and sequence of Table of Contents of this Project Manual.

I. Contents: Prepare a Table of Contents for each volume, with each product or system description identified, in three parts as follows:
   1. Part 1: Directory, listing names, addresses, and telephone numbers of Architect, Contractor, Subcontractors, and major equipment suppliers.
   2. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
      a. Significant design criteria.
      b. List of equipment.
      c. Parts list for each component.
      d. Operating instructions.
      e. Maintenance instructions for equipment and systems.
      f. Maintenance instructions for special finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
   3. Part 3: Project documents and certificates, including the following:
      a. Shop drawings and product data.

3.6 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 the 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.

END OF SECTION 01780

SECTION 01810 - COMMISSIONING

PART 1 - GENERAL

1.1 SUMMARY

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

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

1.2 SCOPE OF COMMISSIONING

A. The following are to be commissioned:

B. Plumbing Systems:
   1. Water heaters.
   2. Booster pumps.

C. HVAC System, including:
   1. Major and minor equipment items.
   2. Piping systems and equipment.
   3. Ductwork and accessories.
   4. Terminal units.
   5. Control system.
   6. Sound control devices.
   7. Vibration control devices.
   8. Variable frequency drives.

D. Special Ventilation:
   1. Fume hoods.
   2. Laboratory pressurization.
   3. Specialty fans.
   4. Egress pressurization.

E. Electrical Systems:
   1. Power quality.
   2. Emergency power systems.
   3. Lighting controls other than manual switches.

F. Electronic Safety and Security:
   1. Security system, including doors and hardware.
   2. Fire and smoke alarms.

G. Communications:
   1. Voice and data systems.

H. Other equipment and systems explicitly identified elsewhere in Contract Documents as requiring commissioning.

I. Indoor Air Quality Procedures: The Commissioning Authority will coordinate; Contractor will execute; see Section 01734.

1.3 RELATED REQUIREMENTS

A. Section 01734 - Indoor Air Quality: Precautions and procedures; smoking room testing; building flush-out.

B. Section 01700 - Execution Requirements: General startup requirements.

C. Section 01780 - Closeout Submittals: Scope and procedures for operation and maintenance manuals and project record documents.

D. Section 01820 - Demonstration and Training: Scope and procedures for Owner personnel training.

E. Section 01815 - Commissioning Authority Responsibilities.

1.4 REFERENCE STANDARDS

A. PECI (Samples) - Sample Forms for Prefunctional Checklists and Functional Performance Tests; Portland Energy Conservation, Inc.; located at http://www.peci.org/library/mcpgs.htm; current edition.

1.5 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures; except:
   1. Make all submittals specified in this section, and elsewhere where indicated for commissioning purposes, directly to the Commissioning Authority, unless they require review by Architect; in that case, submit to Architect first.
   2. Submit one copy to the Commissioning Authority, not to be returned.
   3. Make commissioning submittals on time schedule specified by Commissioning Authority.
   4. Submittals indicated as "Draft" are intended for the use of the Commissioning Authority in preparation of Prefunctional Checklists or Functional Test requirements; submit in editable electronic format, Microsoft Word 2003 preferred.
   5. As soon as possible after submittals made to Architect are approved, submit copy of approved submittal to the Commissioning Authority.

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

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

D. Startup Plans and Reports.

E. Completed Prefunctional Checklists. PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

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

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

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

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

PART 3 - EXECUTION

3.1 COMMISSIONING PLAN

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

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

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

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

3.2 DOCUMENTATION IDENTIFICATION SYSTEM

A. Give each submitted form or report a unique identification; use the following scheme.

B. Type of Document: Use the following prefixes:
   1. Startup Plan: SP-.
   2. Startup Report: SR-.
   3. Prefunctional Checklist: PC-.
   4. Functional Test Procedure: FTP-.
   5. Functional Test Report: FTR-.

C. System Type: Use the first 4 digits from CSI/CSC MasterFormat, 2004 Edition, that are applicable to the system; for example:
   1. 2300: HVAC system as a whole.
   2. 2320: HVAC Piping and Pumps.
   3. 2330: HVAC Air Distribution.

D. Component Number: Assign numbers sequentially, using 1, 2, or 3 digits as required to accommodate the number of units in the system.

E. Test, Revision, or Submittal Number: Number each successive iteration sequentially, starting with 1.

F. Example: PC-2320-001.2 would be the Prefunctional Checklist for equipment item 1 in the HVAC piping system, probably a pump; this is the second, revised submittal of this checklist.

3.3 STARTUP PLANS AND REPORTS

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

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

C. Submit directly to the Commissioning Authority.

3.4 PREFUNCTIONAL CHECKLISTS

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

B. Contractor is responsible for filling out Prefunctional Checklists, after completion of installation and before startup; witnessing by the Commissioning Authority is not required unless otherwise specified.
   1. Each line item without deficiency is to be witnessed, initialed, and dated by the actual witness; checklists are not complete until all line items are initialed and dated complete without deficiencies.

2. Checklists with incomplete items may be submitted for approval provided the Contractor attests that incomplete items do not preclude the performance of safe and reliable Functional Testing; re-submission of the Checklist is required upon completion of remaining items.
3. Individual Checklists may contain line items that are the responsibility of more than one installer; Contractor shall assign responsibility to appropriate installers or subcontractors, with identification recorded on the form.
4. If any Checklist line item is not relevant, record reasons on the form.
5. Contractor may independently perform startup inspections and/or tests, at his option.
6. Regardless of these reporting requirements, Contractor is responsible for correct startup and operation.
7. Submit completed Checklists to Commissioning Authority within two days of completion.

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

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

E. Deficiencies: Correct deficiencies and re-inspect or re-test, as applicable, at no extra cost to Owner.
1. If difficulty in correction would delay progress, report deficiency to the Commissioning Authority immediately.

3.5 FUNCTIONAL TESTS

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

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

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

D. Contractor is responsible for correction of deficiencies and re-testing at no extra cost to Owner; if a deficiency is not corrected and re-tested immediately, the Commissioning Authority will document the deficiency and the Contractor's stated intentions regarding correction.

1. Deficiencies are any condition in the installation or function of a component, piece of equipment or system that is not in compliance with the Contract Documents or does not perform properly.
2. When the deficiency has been corrected, the Contractor completes the form certifying that the item is ready to be re-tested and returns the form to the Commissioning Authority; the Commissioning Authority will reschedule the test and the Contractor shall re-test.
3. Identical or Near-Identical Items: If 10 percent, or three, whichever is greater, of identical or near-identical items fail to perform due to material or manufacturing defect, all items will be considered defective; provide a proposal for correction within 2 weeks after notification of defect, including provision for testing sample installations prior to replacement of all items.
4. Contractor shall bear the cost of Owner and Commissioning Authority personnel time witnessing re-testing.
5. Contractor shall bear the cost of Owner and Commissioning Authority personnel time witnessing re-testing if the test failed due to failure to execute the relevant Prefunctional Checklist correctly; if the test failed for reasons that would not have been identified in the Prefunctional Checklist process, Contractor shall bear the cost of the second and subsequent re-tests.

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

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

3.6 SENSOR AND ACTUATOR CALIBRATION

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

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

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

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

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

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

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

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

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

3.7 TEST PROCEDURES - GENERAL

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

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

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

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

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

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

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

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

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

3.8 OPERATION AND MAINTENANCE MANUALS

A. See Section 01780 for additional requirements.

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

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

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

END OF SECTION 01810

SECTION 01815 - COMMISSIONING AUTHORITY RESPONSIBILITIES

PART 1 - GENERAL

1.1 SUMMARY

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

B. Commissioning, including Functional Tests, O&M documentation review, and training, is to occur after startup and initial checkout and be completed before Substantial Completion.

C. Coordinate and direct all the commissioning activities in a logical, sequential and efficient manner using consistent protocols and forms, centralized documentation, clear and regular communications and consultations with all necessary parties, frequently updated timelines and schedules and technical expertise.

D. The Commissioning Authority is to be employed by Owner.

E. The scope of commissioning activities is defined in Section 01810 - Commissioning.

1.2 REFERENCE STANDARDS

A. ASHRAE Guideline 1 - The HVAC Commissioning Process; 1996

B. PECI (MCGS) – Model Commissioning Guide Specifications; Portland Energy Conservation, Inc.; located at http://www.peci.org/library/mcpgs.htm; current edition.

C. PECI (MCP) - Model Commissioning Plan; Portland Energy Conservation, Inc.; located at http://www.peci.org/library/mcpgs.htm; current edition.

1.3 SUBMITTALS

A. Commissioning Plan:
   1. Submit preliminary draft for review by Owner and Architect within 30 days after commencement of Commissioning Authority contract.
   2. Submit revised draft to be included in the construction contract documents, not less than 4 weeks prior to bid date.
   3. Submit final plan not more than 90 days after commencement of construction, for issuance to all parties.

B. List of Prefunctional Checklists to be developed:
   1. Submit preliminary list at start of construction documents phase or within 30 days after commencement of contract, whichever is later.
   2. Submit revised list not less than 6 weeks prior to bid date, for inclusion in the construction contract documents.
   3. Submit final list not more than 60 days after start of construction.

C. Prefunctional Checklists:
   1. Submit preliminary draft at start of construction documents phase or within 30 days after commencement of contract, whichever is later.
   2. Submit revised draft for review by Owner and Architect not less than 6 weeks prior to bid date, for inclusion in the construction contract documents.
   3. Submit final draft to Contractor not less than 4 weeks prior to startup of particular items to be commissioned.

D. List of Functional Test procedures to be developed:
   1. Submit preliminary list at start of construction documents phase or within 30 days after commencement of contract, whichever is later.
   2. Submit revised list not less than 6 weeks prior to bid date, for inclusion in the Contract Documents; this is intended to be a list of titles, not full description of the tests.
   3. Submit final list not more than 60 days after start of construction.

E. Functional Test Procedures:
   1. Submit preliminary draft at start of construction documents phase or within 30 days after commencement of contract, whichever is later.
   2. Submit revised draft for review by Owner and Architect not less than 6 weeks prior to bid date, for inclusion in the construction contract documents.
   3. Submit final draft to Contractor not less than 4 weeks prior to startup of particular items to be commissioned.

F. Training Plan.

G. Commissioning Record: Submit to Contractor for inclusion with O&M manuals.

H. Final Commissioning Report: Submit to Owner.

I. Recommissioning Manual: Submit within 60 days after receipt of Owner's instructions to proceed with preparation.

PART 2 - PRODUCTS

2.1 DOCUMENTATION IDENTIFICATION SYSTEM

A. Give each submitted form or report a unique identification; use the following scheme.

B. Type of Document: Use the following prefixes:
   1. Commissioning Plan: CP-.
   2. Prefunctional Checklist: PC-.
   3. Functional Test Procedure: FTP-.
   4. Functional Test Report: FTR-.
   5. Commissioning Report: CR-.

C. System Type: Use the first 4 digits from CSI/CSC MasterFormat, 2004 Edition, that are applicable to the system; for example:
   1. 2300: HVAC system as a whole.
   2. 2320: HVAC Piping and Pumps.
   3. 2330: HVAC Air Distribution.

D. Component Number: Assign numbers sequentially, using 1, 2, or 3 digits as required to accommodate the number of units in the system.

E. Test, Revision, or Submittal Number: Number each successive iteration sequentially, starting with 1.

F. Example: PC-2320-001.2 would be the Prefunctional Checklist for equipment item 1 in the HVAC piping system, probably a pump; this is the second, revised submittal of this checklist.

PART 3 - EXECUTION

3.1 COMMISSIONING PLAN

A. Prepare and maintain the Commissioning Plan, covering commissioning schedule, Prefunctional Checklist and Functional Test procedures, coordination requirements, and forms to be used, for all parties in the commissioning process.
   1. Call and chair meetings of the Commissioning Team when appropriate.
   2. Give Contractor sufficient notice for scheduling commissioning activities.
   3. Develop a comprehensive start-up and initial systems checkout plan with cooperation of Contractor and subcontractors.
   4. The PECI Model Commissioning Plan may be used as a guide for the Commissioning Plan.
   5. ASHRAE Guideline 1 may be used as a guide for the Commissioning Plan.
   6. Avoid replication of information included in the construction contract documents to the greatest extent possible.

B. Review the construction contract documents for Contractor submittals of draft checklists, draft test procedures, manufacturer startup procedures, and other information intended for the use of the Commissioning Authority in preparing the Commissioning Plan.

C. Commissioning Schedule:
   1. Coordinate with Contractor anticipated dates of startup of each item of equipment and system.
   2. Contractor's scheduling responsibilities are specified in the construction contract documents.
   3. Revise and re-issue schedule monthly.
   4. Prefunctional Checklists and Functional Tests are to be performed in sequence from components, to subsystems, to systems.
   5. Deliver relevant Prefunctional Checklists and Functional Test Procedures to Contractor in time to avoid delay.

3.2 CONSTRUCTION CONTRACT DOCUMENTS

A. General Commissioning Specifications: Architect has prepared general commissioning specifications for inclusion in the construction contract documents; review and submit comments to Owner.
   1. These specifications include:
      a. Procedures applicable to all types of items to be commissioned.
   2. Prepare specifications for any of the following that would be recommended, for incorporation into the construction contract documents by Architect:
      a. Additional Contractor submittals needed for purposes of commissioning, such as startup procedures, draft test procedures, draft training plans, etc.
      b. Additional Owner personnel training.
      c. Additional operation or maintenance data that should be submitted.

B. Prefunctional Checklists: Develop detailed Checklists for each item to be commissioned.
   1. List of Checklists to be Developed: Prepare and maintain a detailed list of titles, not full text.
   2. The Checklist forms are intended to be part of the Contractor's Contract Documents.

C. Functional Testing: Develop detailed procedures for each item to be commissioned; submit for review by Owner and Architect.
   1. List of Test Procedures to be Developed: Prepare and maintain a detailed list of titles, not full text.
   2. The forms the Commissioning Authority will use to report Functional Test results are not intended to be part of Contractor's Contract Documents, but the Functional Test Procedures that must be executed by the Contractor must be made part of the Contract Documents, by modification if necessary.

D. Develop any other reporting forms Contractor will be required to use; if they are likely to require a substantially different amount of work than the Contractor can reasonably anticipate, they must be included in the construction contract documents.

E. If any part of the documents described above have not been developed by the bid date, coordinate with Architect the issuance of modifications to the construction contract documents

3.3 PREFUNCTIONAL CHECKLISTS

A. Prefunctional Checklists - Content: Prepare forms for Contractor's use, in sufficient detail to document that the work has been installed in accordance with the Contract Documents and the manufacturer’s recommendations and instructions, and that it receives adequate operational checkout prior to startup.
   1. Prepare separate Checklists for each type of equipment, system, or other assembly, customized to the item.
   2. Identify each Checklist by using the contract documents identification number or name, if any; if none, create unique identifiers for each Checklist; do not rely on Contractor to number checklists.
   3. Multiple identical or near-identical items may appear on a single Checklist provided there is space to record all required data for each separately; label each set of data uniquely.

4. Include space to record manufacturer name, model number, serial number, capacity and other relevant characteristics, and accessories and other features as applicable; include space to record "as specified", "as submitted", and "as installed" data.
5. Include space to record whether or not the required submittals have been received; list each separate type of submittal.
6. Include line items for each physical inspection to be performed.
7. Include line items for each operational inspection to be performed, such as checking switch operation, fan rotation, valve and damper stroke, and measuring actual electrical loads.
8. Include separate section for sensors and actuators, with space for documenting actual physical location and calibration measurements; provide a separate generic calibration checklist identified wherever referenced.
9. Include spaces to record that related Checklists for related work upon which this work depends have been completed.

B. Prefunctional Checklists - Format:
1. Provide a cover sheet showing name of equipment item or system, documentation identification number (see Documentation Identification Scheme), names of accessory components involved, and identification of related checklists.
2. Include on cover sheet space for Contractor's use in attesting to completeness; provide spaces for the signatures of the general contractor and each subcontractor or other entity responsible, customized to the project and the type of item.
3. Include on the cover sheet, above the signature block, the following statement: "The work referenced in this Checklist and other work integral to or dependent on this work is complete and ready for functional testing. The checklist items are complete and have been checked off only by parties having direct knowledge of the event." Include two checkboxes:
   a. "This Checklist is submitted for approval with no exceptions."
   b. "This Checklist is submitted for approval, subject to the attached list of outstanding items, none of which preclude the performance of safe and reliable functional tests. A statement of completion will be submitted upon completion of the outstanding items."
4. Use a consistent, tabular format for all Checklists, with one line per checklist activity.
5. For each line item, provide space for initials and date, and identification of the subcontractor or other entity responsible.

3.4 FUNCTIONAL TEST PROCEDURES

A. Develop test procedures in sufficient detail to show that functional performance is in accordance with the Contract Documents and shows proper operation through all modes of operation where there is a different system response, including seasonal, unoccupied, warm-up, cool-down, part- and full-load.
1. Obtain assistance and review by installing subcontractors.
2. Itemize each test sequence in step-by-step order, with acceptance criteria for each step and for the test as a whole.
3. Include test setup instructions, description of tools and apparatus, special cautions, and.
4. Avoid procedures that would void or otherwise limit warranties; review with Contractor prior to execution.
5. For HVAC systems, procedures may include energy management control system trending, stand-alone datalogger monitoring or manual functional testing.
6. Obtain explicit approval of Contractor in regard to feasibility and safety prior to execution.

B. Functional Test Report Forms: Prepare forms in advance of testing, using a consistent format; include all test procedure information given to Contractor and:
   1. Report Identifier (see Documentation Identification Scheme).
   2. Test prerequisites.
   3. Formulas to be used in calculations.
   4. Yes/No check boxes for each step of test.
   5. Space to record results, document deficiencies, and make recommendations.
   6. Signature and date block for Commissioning Authority.

C. Functional Test Prerequisites: Include space to verify all of the following items on each Functional Test Report Form, unless truly inapplicable:
   1. All related equipment has been started up and start-up reports and Prefunctional Checklists submitted and approved ready for Functional Testing.
      a. For hydronic systems, check that:
         1) Piping system flushing is complete and required report approved.
         2) Water treatment system is complete and operational.
         3) Test and balance (TAB) is complete and approved.
   2. All control system functions for this and all interlocking systems are programmed and operable in accordance with the Contract Documents, including final set points and schedules with debugging, loop tuning and sensor calibrations completed, with space for signature of controls installer.
   3. Incomplete items identified by Architect during closeout inspections have been corrected or completed.
   4. Safeties and operating ranges have been reviewed.
   5. A copy of the specified sequence of operation is attached.
   6. A copy of applicable schedules and setpoints is attached.
   7. A copy of the specified Functional Test Procedures is attached.
   8. The Functional Test Procedures have been reviewed and approved by the applicable installer.
   9. Vibration control report approved (if required).
   10. False loading equipment, system and procedures ready.
   11. Sufficient clearance around equipment for servicing.
   12. Original values of pre-test setpoints that need to be changed to accommodate testing have been recorded, with a check box provided to verify return to original values (include control parameters, limits, delays, lockouts, schedules, etc.).
   13. Any other items on the Prefunctional Checklist or Start-up Reports that need to be re-verified.

3.5 CONSTRUCTION PHASE

A. Coordinate the commissioning work with Contractor and Construction Manager, ensure that commissioning activities are being incorporated into the master schedule.

B. Perform site visits, as necessary, to observe component and system installations. Attend planning and job-site meetings to obtain information on construction progress. Review Contractor's meeting minutes for issues relating to the commissioning process. Assist in resolving discrepancies.

C. Commissioning Kick-Off Meeting: Plan and conduct a meeting early in the construction phase to review commissioning activities and responsibilities with all parties involved. Require attendance by all members of the Commissioning Team.

D. Conduct periodic meetings as necessary to coordinate, resolve planning issues, and aid in resolution of deficiencies, minimizing the time spent by Contractor and Owner personnel; hold meetings at least monthly.

E. Submit periodic progress reports to Owner and Contractor.

F. Review Contractor shop drawing submittals applicable to systems being commissioned for compliance with commissioning needs; verify that Owner's responsibilities are clearly defined in warranties.

G. Review and approve submittals directly related to commissioning.

H. Deliver Prefunctional Checklists and Functional Test procedures to Contractor.

I. Verify satisfactory completion of Prefunctional Checklists by Contractor by reviewing checklists and by site observation and spot checking; provide formal approval when satisfactory.

J. Verify startup of all systems by reviewing start-up reports and by site observation; provide formal approval when satisfactory.

K. Coordinate, witness and approve Functional Tests performed by Contractor. Coordinate retesting until satisfactory performance is achieved.

L. HVAC Commissioning:
   1. Gather and review the control sequences and interlocks and work with Contractor and design engineers until sufficient clarity has been obtained, in writing, to be able to prepare detailed Functional Test procedures.
   2. Witness all or part of HVAC piping test and flushing procedures, sufficient to be confident that proper procedures were followed; document testing and include documentation in O&M manuals.
   3. Witness all or part of duct testing and cleaning procedures, sufficient to be confident that proper procedures were followed; document testing and include documentation in O&M manuals.
   4. Review TAB Plan prepared by Contractor.
   5. Before TAB is executed, witness sufficient Functional Testing of the control system to approve it to be used for TAB.
   6. Verify air and water systems balancing by spot testing, by reviewing completed reports, and by site observation; provide formal approval when satisfactory.
   7. Analyze trend logs and monitoring data to verify performance.

M. Witness and document testing of systems and components over which the Commissioning Authority does not have direct control, such as smoke control systems, tests contracted directly by Owner, and tests by manufacturer’s personnel; include documentation in O&M manuals.

N. When Functional Testing for specific systems or equipment is specified to be performed by the Commissioning Authority rather than the Contractor, perform such testing without assistance of Contractor.

O. Perform Functional Testing for systems and equipment so specified, without assistance of Contractor.

P. Maintain a master deficiency and resolution log and a separate testing record. Provide written progress and test reports with recommended actions.

Q. O&M Data: Review submitted operation and maintenance data for completeness; provide formal approval if satisfactory.

R. Notify Contractor and Owner of deficiencies in procedures or results; suggest solutions.

3.6 TRAINING

A. Training Plan: Prepare a comprehensive Training Plan, incorporating draft training plans submitted by Contractor.
   1. Include a 2-hour session by the HVAC design engineer covering the overall HVAC system and equipment design concepts, with one-line schematic drawings.
   2. Include a 2-hour session by the Commissioning Authority on the use of the blank Prefunctional Checklists and Functional Test report forms for re-commissioning purposes.
   3. Establish criteria for determining satisfactory completion of training.

B. Verify that training was satisfactorily completed; provide formal approval if satisfactory.

3.7 CLOSEOUT

A. Commissioning Record: Use the same format and organization as specified for the O&M manuals.
   1. Include the Final Commissioning Plan and Final Report.
   2. For each product or system and equipment item, include the following organized as indicated, with separator tabs:
      a. Design intent documentation, furnished by Architect or others.
      b. Detailed operational sequences.
      c. Startup plan and approved startup reports.
      d. Filled out Prefunctional Checklists.
      e. Filled out Functional Test reports; trend logs and monitoring reports and analysis; other verification documentation.
      f. Training plan and training records.
      g. Recommissioning recommendations, including time schedule and procedures; include blank copies of all Prefunctional Checklists and Functional Test report forms.

B. Final Commissioning Report: Include:
   1. Executive summary.
   2. List of participants and roles.
   3. Brief facility description.
   4. Overview of commissioning scope and general description of testing and verification methods.

5. For each item commissioned, an evaluation of adequacy of:
   a. The product itself; i.e. compliance with the contract documents.
   b. Installation.
   c. Functional performance; include a brief description of the verification method used and observations and conclusions from the testing.
   d. O&M documentation, including design intent.
   e. Operator training.
6. List of all outstanding non-compliance items, referenced to the specific functional test, inspection, trend log, etc., where the deficiency is documented.
7. List of unresolved issues, seasonal or deferred testing, and other concerns that could affect facility operation.
8. Recommendations for improvement to equipment or operations, future actions, commissioning process changes, etc. (about four to six pages).
9. Attach appendices containing all commissioning documentation, including logs, minutes, reports, deficiency lists, communications, findings, etc., except that specified to be part of the Commissioning Record.

C. Recommissioning Manual: Revise the Commissioning Plan documents, checklists, and Functional Test forms as necessary based on accepted recommendations of the final Commissioning Report. Provide step-by-step instructions for recommissioning, blank forms, and cross-references to O&M data needed during recommissioning.

3.8 POST-OCCUPANCY PHASE

A. Coordinate deferred and seasonal Functional Tests; verify correction of deficiencies.

B. On-Site Review: 10 months after Substantial Completion conduct on-site review with Owner's staff.
   1. Review the current facility operation and condition of outstanding issues related to the original and seasonal commissioning.
   2. Interview staff to identify problems or concerns they have operating the facility as originally intended.
   3. Make suggestions for improvements and for recording these changes in the O&M manuals.
   4. Identify areas of concern that are still under warranty or are the responsibility of the original construction contractor.
   5. Assist facility staff in developing reports, documents and requests for services to remedy outstanding problems.

END OF SECTION 01815

SECTION 01820 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 SUMMARY

A. Demonstration of products and systems to be commissioned and where indicated in specific specification sections.

B. Training of Owner personnel in operation and maintenance is required for:

C. Training of Owner personnel in care, cleaning, maintenance, and repair is required for:
   1. Roofing, waterproofing, and other weather-exposed or moisture protection products.
   2. Finishes, including flooring, wall finishes, ceiling finishes.
   3. Fixtures and fittings.
   4. Items specified in individual product Sections.

1.2 RELATED REQUIREMENTS

A. Section 01780 - Closeout Submittals: Operation and maintenance manuals.

B. Section 01810 - Commissioning: Additional requirements applicable to demonstration and training.

1.3 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures; except:
   1. Make all submittals specified in this section, and elsewhere where indicated for commissioning purposes, directly to the Commissioning Authority.
   2. Submit one copy to the Commissioning Authority, not to be returned.
   3. Make commissioning submittals on time schedule specified by Commissioning Authority.
   4. Submittals indicated as "Draft" are intended for the use of the Commissioning Authority in preparation of overall Training Plan; submit in editable electronic format, Microsoft Word 2003 preferred.

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

provided by Contractor.

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

D. Video Recordings: Submit digital video recording of each demonstration and training session for Owner's subsequent use.
   1. Format: DVD Disc.
   2. Label each disc and container with session identification and date.

1.4 QUALITY ASSURANCE

A. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.
   1. Provide as instructors the most qualified trainer of those contractors and/or installers who actually supplied and installed the systems and equipment.
   2. Where a single person is not familiar with all aspects, provide specialists with necessary qualifications.

PART 2 - PRODUCTS - NOT USED PART 3 - EXECUTION

3.1 DEMONSTRATION - GENERAL

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

B. Demonstrations conducted during Functional Testing need not be repeated unless Owner personnel training is specified.

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

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

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

3.2 TRAINING - GENERAL

A. Commissioning Authority will prepare the Training Plan based on draft plans submitted.

B. Conduct training on-site unless otherwise indicated.

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

D. Do not start training until Functional Testing is complete, unless otherwise specified or approved by the Commissioning Authority.

E. Provide training in minimum two hour segments.

F. The Commissioning Authority is responsible for determining that the training was satisfactorily completed and will provide approval forms.

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

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

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

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

END OF SECTION 01820

SECTION 02080 - PIPED UTILITIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
1. Piping joining materials.
2. Transition fittings.
3. Identification devices.
4. Grout.
5. Flowable fill.
6. Piped utility demolition.
7. Piping system common requirements.
8. Painting.
9. Concrete bases.

1.3 DEFINITIONS

A. Exposed Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions.

B. Concealed Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

C. ABS: Acrylonitrile-butadiene-styrene plastic.

D. CPVC: Chlorinated polyvinyl chloride plastic.

E. PE: Polyethylene plastic.

F. PVC: Polyvinyl chlorideplastic.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:
1. Dielectric fittings.
2. Identification devices.

1.5 QUALITY ASSURANCE

A. Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 COORDINATION

A. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

B. Coordinate installation of identifying devices after completing covering and painting if devices are applied to surfaces.

C. Coordinate size and location of concrete bases. Formwork, reinforcement, and concrete requirements are specified in Section 03300 "Cast-in-Place Concrete.".

PART 2 - PRODUCTS

2.1 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness, unless otherwise indicated.
    a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
    b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
2. AWWA C110, rubber, flat face, 1/8-inch thick, unless otherwise indicated; and full- face or ring type, unless otherwise indicated.

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

E. Solvent Cements for Joining Plastic Piping:

1. ABS Piping: ASTM D 2235.
2. CPVC Piping: ASTM F 493.
3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
4. PVC to ABS Piping Transition: ASTM D 3138.

2.2 TRANSITION FITTINGS

A. Transition Fittings, General: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.

B. Transition Couplings NPS 1-1/2 and Smaller:
   1. Underground Piping: Manufactured piping coupling or specified piping system fitting.
   2. Aboveground Piping: Specified piping system fitting.

C. AWWA Transition Couplings NPS 2 and Larger:
   1. Description: AWWA C219, metal sleeve-type coupling for underground pressure piping.

D. Flexible Transition Couplings for Underground Nonpressure Drainage Piping:
   1. Description: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.

2.3 SLEEVES

A. PVC Pipe Sleeves: ASTM D 1785, Schedule 40.

2.4 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
   1. Characteristics: Posthar dening, volume adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
   2. Design Mix: 5000-psi, 28-day compressive strength.
   3. Packaging: Premixed and factory packaged.

2.5 FLOWABLE FILL

A. Description: Low-strength-concrete, flowable-slurry mix.
   1. Cement: ASTM C 150, Type I, Portland.
   2. Density: 115- to 145-lb/cu. ft.
   3. Admixture: ASTM C 618, fly-ash mineral.
   4. Water: Comply with ASTM C 94/C 94M.
   5. Strength: 100 to 200 psig at 28 days. PART 3 - EXECUTION

3.1 PIPED UTILITY DEMOLITION

A. Disconnect, demolish, and remove piped utility systems, equipment, and components indicated to be removed.
   1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
   2. Piping to Be Abandoned in Place: Drain piping. Fill abandoned piping with flowable fill, and cap or plug piping with same or compatible piping material.
   3. Equipment to Be Removed: Disconnect and cap services and remove equipment.
   4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make operational.
   5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

B. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 PIPING INSTALLATION

A. Install piping according to the following requirements and utilities Sections specifying piping systems.

B. Install piping to permit valve servicing.

C. Install piping at indicated slopes.

D. Install piping free of sags and bends.

E. Install fittings for changes in direction and branch connections.

F. Select system components with pressure rating equal to or greater than system operating pressure.

G. Sleeves are not required for core-drilled holes.

H. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

I. Verify final equipment locations for roughing-in.

J. Refer to equipment specifications in other Sections for roughing-in requirements.

3.3 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and utilities Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

E. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

F. Grooved Joints: Assemble joints with grooved-end pipe coupling with coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

G. Soldered Joints: Apply ASTM B 813 water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy (0.20 percent maximum lead content) complying with ASTM B 32.

H. Pressure-Sealed Joints: Assemble joints for plain-end copper tube and mechanical pressure seal fitting with proprietary crimping tool to according to fitting manufacturer's written instructions.

I. Plastic Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 appendixes.
3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
5. PVC Nonpressure Piping: Join according to ASTM D 2855.
6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.

3.4 EQUIPMENT INSTALLATION

A. Install equipment level and plumb, unless otherwise indicated.

B. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference with other installations. Extend grease fittings to an accessible location.

C. Install equipment to allow right of way to piping systems installed at required slope.

3.5 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Section 03300 "Cast-in-Place Concrete."

3.6 GROUTING

A. Mix and install grout for equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

END OF SECTION 02080

SECTION 02225 - DEMOLITION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Building demolition.

B. Selective demolition of built site elements.

C. Abandonment and removal of existing utilities and utility structures.

1.2 RELATED REQUIREMENTS

A. Section 01100 - Summary: Limitations on Contractor's use of siteand premises.

B. Section 01500 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.

C. Section 01575 - Temporary Erosion and Sedimentation Control.

D. Section 01700 - Execution Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.

E. Section 01732 - Waste Management: Limitations on disposal of removed materials; requirements for recycling.

F. Section 02230 - Site Clearing: Vegetation and existing debris removal.

G. Section 02310 - Grading: Fill material for filling holes, pits, and excavations generated as a result of removal operations.

1.3 REFERENCE STANDARDS

A. 29 CFR 1926 - U.S. Occupational Safety and Health Standards; current edition.

1.4 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Site Plan: Showing:

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

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

1.5 QUALITY ASSURANCE

A. Demolition Firm Qualifications: Company specializing in the type of work required.

PART 2 PRODUCTS

2.1 MATERIALS

A. Fill Material: As specified in Section 02300 Earthwork PART 3 - EXECUTION

3.1 SCOPE

A. Remove the entire building(s) as indicated on the Drawings.

B. Remove paving and curbs as required to accomplish new work.

C. Remove all other paving and curbs within site boundaries.

D. Within area of new construction, remove foundation walls and footings to a minimum of 2 feet below finished grade.

E. Outside area of new construction, remove foundation walls and footings to a minimum of 2 feet below finished grade.

F. Remove concrete slabs on grade within site boundaries.

G. Remove manholes and manhole covers, curb inlets and catch basins.

H. Remove fences and gates.

I. Remove other items indicated, for recycling.

J. Fill excavations, open pits, and holes in ground areas generated as result of removals, using specified fill; compact fill as required so that required rough grade elevations do not subside within one year after completion.

3.2 GENERAL PROCEDURES AND PROJECT CONDITIONS

A. Comply with other requirements specified in Section 01700.

B. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.

1. Obtain required permits.
2. Use of explosives is not permitted.
3. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
4. Provide, erect, and maintain temporary barriers and security devices.
5. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
6. Do not close or obstruct roadways or sidewalks without permit.

7. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.
8. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon or limit access to their property.

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

D. Protect existing structures and other elements that are not to be removed.
1. Provide bracing and shoring.
2. Prevent movement or settlement of adjacent structures.
3. Stop work immediately if adjacent structures appear to be in danger.

E. Partial Removal of Paving and Curbs: Neatly saw cut at right angle to surface.

3.3 EXISTING UTILITIES

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

B. Protect existing utilities to remain from damage.

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

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

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

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

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

3.4 DEBRIS AND WASTE REMOVAL

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

B. Remove from site all materials not to be reused on site; comply with requirements of Section 01732 - Waste Management.

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

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

END OF SECTION 02225

SECTION 02235 - SITE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Protecting existing vegetation to remain.
2. Removing existing vegetation.
3. Clearing and grubbing.
4. Stripping and stockpiling topsoil.
5. Removing above- and below-grade site improvements.
6. Disconnecting, capping or sealing, and removing site utilities.
7. Temporary erosion- and sedimentation-control measures.

B. Related Sections:
1. Section 01500 "Temporary Facilities and Controls" for temporary utility services, construction and support facilities, security and protection facilities.
2. Section 01700 "Execution Requirements" for field engineering and surveying.
3. Section 02225 "Building Demolition" for demolition of buildings, structures, and site improvements.

1.3 DEFINITIONS

A. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

B. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.

C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil and is the zone where plant roots grow. Its appearance is generally friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free of subsoil and weeds, roots, toxic materials, or other nonsoil materials.

D. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction, and indicated on Drawings.

E. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and defined by a circle concentric with each tree with a radius 1.5 times the diameter of the drip line unless otherwise indicated.

F. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 MATERIAL OWNERSHIP

A. Except for stripped topsoil and other materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.5 INFORMATIONAL SUBMITTALS

A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.

1. Use sufficiently detailed photographs or videotape.
2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.

B. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.6 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises as directed by the construction manager.

C. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.

D. Do not commence site clearing operations until temporary erosion- and sedimentation-control and plant-protection measures are in place.

E. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

F. Do not direct vehicle or equipment exhaust towards protection zones.

G. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

H. Soil Stripping, Handling, and Stockpiling: Perform only when the topsoil is dry or slightly moist.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 02300 "Earthwork."

1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

B. Antirust Coating: Fast-curing, lead- and chromate-free, self-curing, universal modified- alkyd primer complying with MPI #79, Alkyd Anticorrosive Metal Primer.

C. VOC limit in subparagraph below is the EPA limit for rust-preventive architectural coatings; revise to suit Project.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Locate and clearly identify trees, shrubs, and other vegetation to remain. Flag each tree trunk at 54 inches above the ground.

C. Protect existing site improvements to remain from damage during construction.

1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction.

B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

C. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.

D. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.3 TREE AND PLANT PROTECTION

A. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Architect.

3.4 EXISTING UTILITIES

A. Locate, identify, disconnect, and seal or cap utilities indicated to be removed.
   1. Arrange with the power company to shut off indicated utilities.

B. Locate, identify, and disconnect utilities indicated to be abandoned in place.

C. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
   1. Notify Construction Manager not less than two days in advance of proposed utility interruptions.
   2. Do not proceed with utility interruptions without Architect's written permission.

D. Excavate for and remove underground utilities indicated to be removed.

E. Removal of underground utilities is included in earthwork sections and with applicable fire suppression, plumbing, HVAC, electrical, communications, electronic safety and security and utilities sections and Section 02221 "Building Demolition".

3.5 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.
   1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
   2. Use only hand methods for grubbing within protection zones.
   3. Chip removed tree branches and dispose of off-site.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
   1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches, and compact each layer to a density equal to adjacent original ground.

3.6 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil in a manner to prevent intermingling with underlying subsoil or other waste materials.
   1. Remove subsoil and nonsoil materials from topsoil, including clay lumps, gravel, and other objects more than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.
   1. Limit height of topsoil stockpiles to 72 inches.
   2. Do not stockpile topsoil within protection zones.
   3. Dispose of surplus topsoil. Surplus topsoil is that which exceeds quantity indicated to be stockpiled or reused.

3.7 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.

1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw- cut faces vertically.

2. Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.

3.8 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

END OF SECTION 02235

SECTION 02305 – EARTHWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Preparing subgrades for slabs-on-grade walks pavements turf and grasses and plants.
2. Excavating and backfilling for buildings and structures.
3. Drainage course for concrete slabs-on-grade.
4. Subsurface drainage backfill for walls and trenches.
5. Excavating and backfilling trenches for utilities and pits for buried utility structures.

B. Related Sections:
1. Division 1 Section "Photographic Documentation" for recording pre-excavation and earth moving progress.
2. Division 2 Demolition for filling in open areas after demolition removal.
3. Divisions 2, 15, and 16 Sections for installing underground mechanical and electrical utilities and buried mechanical and electrical structures.

1.3 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.
1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.

C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Construction Manager. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices.
2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

G. Fill: Soil materials used to raise existing grades.

H. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

I. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

J. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

K. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.4 SUBMITTALS

A. Product Data: For each type of the following manufactured products required:
1. Geotextiles.
2. Controlled low-strength material, including design mixture.
3. Warning tapes.

B. Samples for Verification: For the following products, in sizes indicated below:
1. Geotextile: 12 by 12 inches.
2. Warning Tape: 12 inches long; of each color.

C. Qualification Data: For qualified testing agency.

D. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:
1. Classification according to ASTM D 2487.
2. Laboratory compaction curve according to ASTM D 698.

E. Preexcavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by earth moving operations. Submit before earth moving begins.

1.5 QUALITY ASSURANCE

A. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E 329 and ASTM D 3740 for testing indicated.

1.6 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth moving operations.
1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. Utility Locator Service: Notify utility locator service for area where Project is located before beginning earth moving operations.

C. Do not commence earth moving operations until temporary erosion- and sedimentation- control measures, specified in Division 2 Section "Site Clearing," are in place.

D. Do not commence earth moving operations until plant-protection measures specified in Division 2 Section "Tree Protection and Trimming" are in place.

E. The following practices are prohibited within protection zones:
1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

F. Do not direct vehicle or equipment exhaust towards protection zones.

G. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: Soil Classification Groups SC-SM, SC, SC-SM or CL, according to the United Soil Classification System with 30% to 70% passing the # 200 mesh sieve, or a combination of these groups; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
1. Liquid Limit: 40 or less.
2. Plasticity Index: 6-18.
3. Minimum dry unit weight: 110 PCF

C. Unsatisfactory Soils: Soil Classification Groups GC, ML, OL, CH, MH, OH, and PT according to ASTM D 2487, or a combination of these groups.
1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2- inch sieve and not more than 8 percent passing a No. 200 sieve.

E. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

F. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.

G. Drainage Course: Narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

H. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1- inch sieve and 0 to 5 percent passing a No. 4 sieve.

I. Sand: ASTM C 33; fine aggregate.

J. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.2 GEOTEXTILES

A. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

1. Grab Tensile Strength: 157 lbf; ASTM D 4632.
2. Sewn Seam Strength: 142 lbf; ASTM D 4632.
3. Tear Strength: 56 lbf; ASTM D 4533.
4. Puncture Strength: 56 lbf; ASTM D 4833.
5. Apparent Opening Size: No. 60 sieve, maximum; ASTM D 4751.
6. Permittivity: 0.2 per second, minimum; ASTM D 4491.
7. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

B. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, made from polyolefins or polyesters; with elongation, less than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

1. Grab Tensile Strength: 247 lbf; ASTM D 4632.
2. Sewn Seam Strength: 222 lbf; ASTM D 4632.
3. Tear Strength: 90 lbf; ASTM D 4533.
4. Puncture Strength: 90 lbf; ASTM D 4833.
5. Apparent Opening Size: No. 60 sieve, maximum; ASTM D 4751.
6. Permittivity: 0.02 per second, minimum; ASTM D 4491.
7. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

C. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:

1. Red: Electric.
2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.

B. Protect and maintain erosion and sedimentation controls during earth moving operations.

C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

3.3 EXPLOSIVES

A. Explosives: Do not use explosives.

3.4 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:
    a. 24 inches outside of concrete forms other than at footings.
    b. 12 inches outside of concrete forms at footings.
    c. 6 inches outside of minimum required dimensions of concrete cast against grade.
    d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
    e. 6 inches beneath bottom of concrete slabs-on-grade.
    f. 6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide.

3.5 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
2. Pile Foundations: Stop excavations 6 to 12 inches above bottom of pile cap before piles are placed. After piles have been driven, remove loose and displaced material. Excavate to final grade, leaving solid base to receive concrete pile caps.
3. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended as bearing surfaces.

B. Excavations at Edges of Tree- and Plant-Protection Zones:

1. Excavate by hand to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
2. Cut and protect roots according to requirements in Division 2 Section "Tree Protection and Trimming."

3.6 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.7 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit unless otherwise indicated.

1. Clearance: As indicated.

C. Trench Bottoms: Excavate trenches deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.

1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

3.8 SUBGRADE INSPECTION

A. Notify Geotech when excavations have reached required subgrade.

B. If Architect determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

C. Proof-roll subgrade below the building slabs and pavements with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction. Limit vehicle speed to 3 mph.
2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices.

E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Construction Manager, without additional compensation.

3.9 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by Construction Manager.

1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Construction Manager.

3.10 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.11 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
2. Surveying locations of underground utilities for Record Documents.
3. Testing and inspecting underground utilities.
4. Removing concrete formwork.
5. Removing trash and debris.
6. Removing temporary shoring and bracing, and sheeting.
7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.12 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Backfill voids with satisfactory soil while removing shoring and bracing.

D. Place and compact initial backfill of satisfactory soil, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the pipe or conduit.

1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

E. Place and compact final backfill of satisfactory soil to final subgrade elevation.

F. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.13 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:

1. Under grass and planted areas, use satisfactory soil material.
2. Under walks and pavements, use satisfactory soil material.
3. Under steps and ramps, use engineered fill.
4. Under building slabs, use engineered fill.
5. Under footings and foundations, use engineered fill.

C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.14 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.15 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698:

1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 98 percent.
2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 95 percent.

3. Under turf or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 92 percent.
4. For utility trenches, compact each layer of backfill soil material at 98 percent.

3.16 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots with required surface tolerances.

B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
1.
2. Turf or Unpaved Areas: Plus or minus 1 inch.
3. Walks: Plus or minus 1 inch.
4. Pavements: Plus or minus 1/2 inch.

C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.17 SUBSURFACE DRAINAGE

A. Subdrainage Pipe: Specified in Division 2 Section "Subdrainage."

B. Subsurface Drain: Place subsurface drainage geotextile around perimeter of subdrainage trench. Place a 6-inch course of filter material on subsurface drainage geotextile to support subdrainage pipe. Encase subdrainage pipe in a minimum of 12 inches of filter material, placed in compacted layers 6 inches thick, and wrap in subsurface drainage geotextile, overlapping sides and ends at least 6 inches.
1. Compact each filter layer to 90% of max. dry unit weight according to ASTM D 698.

C. Drainage Backfill: Place and compact filter material over subsurface drain, in width indicated, to within 12 inches of final subgrade, in compacted layers 6 inches thick. Overlay drainage backfill with one layer of subsurface drainage geotextile, overlapping sides and ends at least 6 inches.
1. Compact each filter material layer to 90 percent of maximum dry unit weight according to ASTM D 698.
2. Place and compact impervious fill over drainage backfill in 6-inch- thick compacted layers to final subgrade.

3.18 BASE COURSES UNDER PAVEMENTS AND WALKS

A. Place base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place base course under pavements and walks as follows:
1. Install separation geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
2. Place base course material over subbase course under hot-mix asphalt pavement.
3. Shape base course to required crown elevations and cross-slope grades.
4. Place base course 6 inches or less in compacted thickness in a single layer.

5. Place base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
6. Compact base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 98 percent of maximum dry unit weight according to ASTM D 698.

3.19 DRAINAGE COURSE UNDER CONCRETE SLABS-ON-GRADE

A. Place drainage course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs- on-grade as follows:
1. Install subdrainage geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
2. Place drainage course 6 inches or less in compacted thickness in a single layer.
3. Place drainage course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
4. Compact each layer of drainage course to required cross sections and thicknesses to not less than 98 percent of maximum dry unit weight according to ASTM D 698.

3.20 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections.

B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.

D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:
1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. or less of paved area or building slab, but in no case fewer than three tests.
2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for every 100 feet or less of wall length, but no fewer than two tests.
3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 100 feet or less of trench length, but no fewer than two tests.

E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.21 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.22 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 02305

SECTION 02361 - SOIL TREATMENT FOR TERMITE CONTROL

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Chemical soil treatment.

1.2 REFERENCE STANDARDS

A. Title 7, United States Code, 136 through 136y - Federal Insecticide, Fungicide and Rodenticide Act; United States Code; 1947 (Revised 2001).

1.3 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Indicate toxicants to be used, composition by percentage, dilution schedule, intended application rate.

C. Test Reports: Indicate regulatory agency approval reports when required.

D. Manufacturer's Application Instructions: Indicate caution requirements.

E. Manufacturer's Certificate: Certify that toxicants meet or exceed specified requirements.

F. Certificate of compliance from authority having jurisdiction indicating approval of toxicants.

G. Warranty: Submit warranty and ensure that forms have been completed in Owner's name.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing this type of work and:
   1. Having minimum of 2 years documented experience.
   2. Approved by manufacturer of treatment materials.
   3. Licensed in Alabama.

1.5 WARRANTY

A. See Section 01780 - Closeout Submittals, for additional warranty requirements.

B. Provide five-year installer's warranty against damage to building caused by termites.
   1. Include coverage for repairs to building and to contents damaged due to building damage. Repair damage and, if required, re-treat.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Manufacturers:
1. Bayer Environmental Science Corp: www.nobugs.com.
2. FMC Professional Solutions: www.fmcprosolutions.com.
3. Syngenta Professional Products: www.syngentaprofessionalproducts.com.
4. Substitutions: See Section 01600 - Product Requirements.

B. Toxicant Chemical: EPA approved; synthetically color dyed to permit visual identification of treated soil.

C. Diluent: Recommended by toxicant manufacturer.

2.2 MIXES

A. Mix toxicant to manufacturer's instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that soil surfaces are unfrozen, sufficiently dry to absorb toxicant, and ready to receive treatment.

3.2 APPLICATION

A. Comply with requirements of U.S. EPA and applicable state and local codes.

B. Spray apply toxicant in accordance with manufacturer's instructions.

C. Apply toxicant at following locations:
1. Under Slabs-on-Grade.
2. At Both Sides of Foundation Surface.

D. Under slabs, apply toxicant immediately prior to installation of vapor barrier.

E. At foundation walls, apply toxicant immediately prior to finish grading work outside foundations.

F. Apply extra treatment to structure penetration surfaces such as pipe or ducts, and soil penetrations such as grounding rods or posts.

G. Re-treat disturbed treated soil with same toxicant as original treatment.

H. If inspection or testing identifies the presence of termites, re-treat soil and re-test.

3.3 PROTECTION

A. Do not permit soil grading over treated work.

END OF SECTION 02361

SECTION 02510 - WATER DISTRIBUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Vortex Water Works and Sanitary Sewer Board Standards and Specifications.

1.2 SUMMARY

A. This Section includes water-distribution piping and related components outside the building for water service and fire-service mains.

B. Utility-furnished products include water meters that will be furnished to the site, ready for installation.

1.3 DEFINITIONS

A. EPDM: Ethylene propylene diene terpolymer rubber.

1.4 SUBMITTALS

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

B. Shop Drawings: Detail precast concrete vault assemblies and indicate dimensions, method of field assembly, and components.
1. Wiring Diagrams: Power, signal, and control wiring for alarms.

C. Coordination Drawings: For piping and specialties including relation to other services in same area, drawn to scale. Show piping and specialty sizes and valves, meter and specialty locations, and elevations.

D. Field quality-control test reports.

E. E. Operation and Maintenance Data: For water valves and specialties to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:
1. Comply with requirements of Vortex Waste Water and Sewer Board. Include tapping of water mains and backflow prevention.
2. Comply with standards of authorities having jurisdiction for potable-water-service piping, including materials, installation, testing, and disinfection.
3. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.

B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

C. Comply with FMG's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.

D. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.

E. NSF Compliance:
1. Comply with NSF 61 for materials for water-service piping and specialties for domestic water.

1.6 DELIVERY, STORAGE, AND HANDLING

A. A. Preparation for Transport: Prepare valves, including fire hydrants, according to the following:
1. Ensure that valves are dry and internally protected against rust and corrosion.
2. Protect valves against damage to threaded ends and flange faces.
3. Set valves in best position for handling. Set valves closed to prevent rattling.

B. During Storage: Use precautions for valves, including fire hydrants, according to the following:
1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
2. Protect from weather. Store indoors and maintain temperature higher than ambient dew-point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.

C. Handling: Use sling to handle valves and fire hydrants if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

D. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.

F. Protect flanges, fittings, and specialties from moisture and dirt.

G. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

1.7 PROJECT CONDITIONS

A. Interruption of Existing Water-Distribution Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water-distribution service according to requirements indicated:
1. Notify Construction Manager no fewer than two days in advance of proposed interruption of service.
2. Do not proceed with interruption of water-distribution service without Construction Manager's written permission.

1.8 COORDINATION

A. Coordinate connection to water main with utility company. PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Soft Copper Tube: ASTM B 88, Type K, water tube, annealed temper.
1. Copper, Solder-Joint Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.
2. Copper, Pressure-Seal Fittings:
a. NPS 2 and Smaller: Wrought-copper fitting with EPDM O-ring seal in each end.
b. NPS 2-1/2 to NPS 4: Bronze fitting with stainless-steel grip ring and EPDM O- ring seal in each end.

B. Hard Copper Tube: ASTM B 88, Type K, water tube, drawn temper.
1. Copper, Solder-Joint Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.
2. Copper, Pressure-Seal Fittings:
a. NPS 2 and Smaller: Wrought-copper fitting with EPDM O-ring seal in each end.
b. NPS 2-1/2 to NPS 4: Bronze fitting with stainless-steel grip ring and EPDM O- ring seal in each end.

C. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.

D. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

2.2 DUCTILE-IRON PIPE AND FITTINGS

A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.
1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile-or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
2. Glands, Gaskets, and Bolts: AWWA C111, ductile-or gray-iron glands, rubber gaskets, and steel bolts.

B. Flanges: ASME 16.1, Class 125, cast iron.

C. Ductile-Iron Deflection Fittings:
1. Description: Compound, ductile-iron coupling fitting with sleeve and 1 or 2 flexing sections for up to 15-degree deflection, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.
a. Pressure Rating: 250 psig minimum.

2.3 JOINING MATERIALS

A. Refer to Division 2 Section "Piped Utilities -Basic Materials and Methods" for commonly used joining materials.

B. Brazing Filler Metals: AWS A5.8, BCuP Series.

2.4 PIPING SPECIALTIES

A. Transition Fittings: Manufactured fitting or coupling same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

B. Tubular-Sleeve Pipe Couplings:
1. Description: Metal, bolted, sleeve-type, reducing or transition coupling, with center sleeve, gaskets, end rings, and bolt fasteners and with ends of same sizes as piping to be joined.
a. Standard: AWWA C219.
b. Center-Sleeve Material: Ductileiron.
c. Gasket Material: Natural or synthetic rubber.
d. Pressure Rating: 200 psig minimum.
e. Metal Component Finish: Corrosion-resistant coating or material.

C. Split-Sleeve Pipe Couplings:
1. Description: Metal, bolted, split-sleeve-type, reducing or transition coupling with sealing pad and closure plates, O-ring gaskets, and bolt fasteners.
a. Standard: AWWA C219.
b. Sleeve Material: Stainless steel.
c. Sleeve Dimensions: Of thickness and width required to provide pressure rating.
d. Gasket Material: O-rings made of EPDM rubber, unless otherwise indicated.
e. Pressure Rating: 200 psig minimum.
f. Metal Component Finish: Corrosion-resistant coating or material.

2.5 CORROSION-PROTECTION PIPING ENCASEMENT

A. Encasement for Underground Metal Piping:
1. Standards: ASTM A 674 or AWWA C105.
2. Form: Sheet or tube.
3. Material: High-density, crosslaminated PE film of 0.004-inch minimum thickness.
4. Color: Black.

2.6 GATE VALVES

A. AWWA, Cast-Iron GateValves:
1. Nonrising-Stem, Resilient-Seated Gate Valves:
a. Description: Gray-or ductile-iron body and bonnet; with bronze or gray-or ductile- iron gate, resilient seats, bronze stem, and stem nut.
1) Standard: AWWA C509.
2) Minimum Pressure Rating: 200 psig.
3) End Connections: Mechanical joint.
4) Interior Coating: Complying with AWWA C550.

2.7 GATE VALVE ACCESSORIES AND SPECIALTIES

A. Tapping-Sleeve Assemblies:
1. Description: Sleeve and valve compatible with drilling machine.
a. Standard: MSS SP-60.
b. Tapping Sleeve: Cast-or ductile-iron or stainless-steel, two-piece bolted sleeve with flanged outlet for new branch connection. Include sleeve matching size and type of pipe material being tapped and with recessed flange for branch valve.
c. Valve: AWWA, cast-iron, nonrising-stem, resilient-seated gate valve with one raised face flange mating tapping-sleeve flange.

B. Valve Boxes: Comply with AWWA M44 for cast-iron valve boxes. Include top section, adjustable extension of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over valve and with a barrel approximately 5 inches in diameter.
1. Operating Wrenches: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.

C. Indicator Posts: UL 789, FMG-approved, vertical-type, cast-iron body with operating wrench, extension rod, and adjustable cast-iron barrel of length required for depth of burial of valve.

2.8 CHECK VALVES

A. AWWA Check Valves:
1. Description: Swing-check type with resilient seat. Include interior coating according to AWWA C550 and ends to match piping.
a. Standard: AWWA C508.
b. Pressure Rating: 175 psig.

2.9 DETECTOR CHECK VALVES

A. Detector Check Valves:
1. Description: Galvanized cast-iron body, bolted cover with air-bleed device for access to internal parts, and flanged ends. Include one-piece bronze disc with bronze bushings, pivot, and replaceable seat. Include threaded bypass taps in inlet and outlet for bypass meter connection. Set valve to allow minimal water flow through bypass meter when major water flow is required.
a. Standards: UL 312 and FMG approved.
b. Pressure Rating: 175 psig.
c. Water Meter: AWWA C700, disc type, at least one-fourth size of detector check valve. Include meter, bypass piping, gate valves, check valve, and connections to detector check valve. Provided by owner and installed by contractor.

2.10 WATER METERS

A. Water meters and any fees associated with the service from the Vortex Water Works and Sewer Board will be the responsibility of the Contractor.

B. Main 8” meter per the NWWSB Standards.

2.11 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers:
1. Standard: ASSE 1013 or AWWA C511.
2. Size: 8”
3. Meeting MWWSSB Standards.
4. Operation: Continuous-pressure applications.
5. Pressure Loss: 12 psig maximum, through middle 1/3 of flow range.
6. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and larger.
7. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
8. Configuration: Designed for horizontal, straight through flow.
9. Accessories:
   a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 and smaller; OS&Y gate type with flanged ends on inlet and outlet of NPS 2-1/2 and larger.
   b. Air-Gap Fitting: ASME A112.1.2, matching backflow preventer connection.

B. Double-Check, Backflow-Prevention Assemblies:
1. Standard: AWWA C510.
2. Operation: Continuous-pressure applications, unless otherwise indicated.
3. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.
4. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and larger.
5. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
6. Configuration: Designed for horizontal, straight through flow.
7. Accessories: Ball valves with threaded ends on inlet and outlet of NPS 2 and smaller; OS&Y gate valves with flanged ends on inlet and outlet of NPS 2-1/2 and larger.

C. Double-Check, Detector-Assembly Backflow Preventers:
1. Standards: ASSE 1048 and UL listed or FMG approved.
2. Operation: Continuous-pressure applications.
3. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.
4. Body: Cast iron with interior lining complying with AWWA C550 or FDA approved.
5. End Connections: Flanged.
6. Configuration: Designed for horizontal, straight through flow.
7. Accessories:
   a. Valves: UL 262, FMG-approved, OS&Y gate type with flanged ends on inlet and outlet.
   b. Bypass: With displacement-type water meter, shutoff valves, and reduced-pressure backflow preventer.

2.12 WATER METER BOXES

A. Description: Cast-iron body and cover for disc-type water meter, with lettering "WATER METER" in cover; and with slotted, open-bottom base section of length to fit over service piping.

B. Description: Polymer-concrete body and cover for disc-type water meter, with lettering "WATER" in cover; and with slotted, open-bottom base section of length to fit over service piping. Include vertical and lateral design loadings of 15,000 lb minimum over 10 by 10 inches square.

2.13 CONCRETE VAULTS

A. All vaults shall meet the requirements of the Vortex Water Works and Sewer Board.

B. Description: Precast, reinforced-concrete vault, designed for A-16 load designation according to ASTM C 857 and made according to ASTM C 858.

1. Ladder: ASTM A 36/A 36M, steel or polyethylene-encased steel steps.
2. Manhole: ASTM A 48/A 48M Class No. 35A minimum tensile strength, gray-iron traffic frame and cover.
    a. Dimension: 24-inch minimum diameter, unless otherwise indicated.
3. Manhole: ASTM A 536, Grade 60-40-18, ductile-iron traffic frame and cover.
    a. Dimension: 24-inch-minimum diameter, unless otherwise indicated.
4. Drain: ASME A112.6.3, cast-iron floor drain with outlet of size indicated. Include body anchor flange, light-duty cast-iron grate, bottom outlet, and integral or field-installed bronze ball or clapper-type backwater valve.

2.14 PROTECTIVE ENCLOSURES

A. Freeze-Protection Enclosures:

1. Description: Insulated enclosure designed to protect aboveground water piping, equipment, or specialties from freezing and damage, with heat source to maintain minimum internal temperature of 40-deg F when external temperatures reach as low as minus 34-deg F.
    a. Standard: ASSE 1060.
    b. Class I: For equipment or devices other than pressure or atmospheric vacuum breakers.
        1) Housing: Reinforced-aluminum or -fiberglass construction.
            (a) Size: Of dimensions indicated, but not less than those required for access and service of protected unit.
            (b) Drain opening for units with drain connection.
            (c) Access doors with locking devices.
            (d) Insulation inside housing.
            (e) Anchoring devices for attaching housing to concrete base.
        2) Electric heating cable or heater with self-limiting temperature control.
            (a) Access doors with locking devices.
            (b) Anchoring devices for attaching housing to concrete base.

B. Enclosure Bases:

1. Description: 6-inch-minimum thickness precast concrete, of dimensions required to extend at least 6 inches beyond edges of enclosure housings. Include openings for piping.

2.15 FIRE HYDRANTS

A. Dry-Barrel Fire Hydrants:

1. Per local fire department requirements.
2. Description: Freestanding, with one NPS 4-1/2 and two NPS 2-1/2 outlets, 5-1/4-inch main valve, drain valve, and NPS 6 mechanical-joint inlet. Include interior coating according to AWWA C550. Hydrant shall have cast-iron body, compression-type valve opening against pressure and closing with pressure.
    a. Standard: AWWA C502.
    b. Pressure Rating: 250 psig.
    c. Outlet Threads: NFPA 1963, with external hose thread used by local fire department. Include cast-iron caps with steel chains.

d. Operating and Cap Nuts: Pentagon, 1-1/2 inches point to flat.
e. Direction of Opening: Open hydrant valve by turning operating nut to left or counterclockwise.
f. Exterior Finish: Red alkyd-gloss enamel paint, unless otherwise indicated.

2.16 FIRE DEPARTMENT CONNECTIONS

A. Fire Department Connections:
1. Manufacturer: Fire hydrants shall be Mueller or approved equal. ADDED BY ADDENDUM NO. 3
2. Description: Freestanding, with cast-bronze body, thread inlets according to NFPA 1963 and matching local fire department hose threads, and threaded bottom outlet. Include lugged caps, gaskets, and chains; lugged swivel connection and drop clapper for each hose-connection inlet; 18-inch-high brass sleeve; and round escutcheon plate.
a. Standard: UL 405.
b. Connections: Two NPS 2-1/2 inlets and one NPS 6 outlet.
c. Inlet Alignment: Inline, horizontal.
d. Finish Including Sleeve: Polished chrome-plated.
e. Escutcheon Plate Marking: "AUTO SPKR."

2.17 ALARM DEVICES

A. All alarm devices to meet AUM standards and requirements.

B. Alarm Devices, General: UL 753 and FMG approved, of types and sizes to mate and match piping and equipment.

C. Water-Flow Indicators: Vane-type water-flow detector, rated for 250-psig working pressure; designed for horizontal or vertical installation; with 2 single-pole, double-throw circuit switches to provide isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal when cover is removed.

D. Supervisory Switches: Single pole, double throw; designed to signal valve in other than fully open position.

E. Pressure Switches: Single pole, double throw; designed to signal increase in pressure.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Refer to Division 2 Section "Earthwork" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

A. General: Use pipe, fittings, and joining methods for piping systems according to the following applications.

B. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used, unless otherwise indicated.

C. Do not use flanges or unions for underground piping.

D. Flanges, unions, grooved-end-pipe couplings, and special fittings may be used, instead of joints indicated, on aboveground piping and piping in vaults.

E. Underground water-service piping NPS 3/4 to NPS 3 shall be the following:
1. Soft copper tube, ASTM B 88, Type K; wrought-copper, solder-joint fittings; and brazed joints.

F. Underground water-service piping NPS 4 to NPS 8 shall be the following:
1. Ductile-iron, mechanical-joint pipe; ductile-iron, mechanical-joint fittings; and mechanical joints.

G. Water Meter Box Water-Service Piping NPS 3/4 to NPS 2 shall be same as underground water-service piping.

H. Aboveground and Vault Water-Service Piping NPS 3/4 to NPS 3 shall be the following:
1. Hard copper tube, ASTM B 88, Type K; wrought-copper, solder-joint fittings; and brazed joints.

I. Aboveground and vault water-service piping NPS 4 to NPS 8 shall be the following:
1. Ductile-iron, grooved-end pipe; ductile-iron, grooved-end appurtenances; and grooved joints.

J. Underground Fire-Service-Main Piping NPS 4 to NPS 12 shall be the following:
1. Ductile-iron, mechanical-joint pipe; ductile-iron, mechanical-joint fittings; and mechanical joints.

K. Aboveground and Vault Fire-Service-Main Piping NPS 4 to NPS 12 shall be ductile-iron, grooved-end pipe; ductile-iron-pipe appurtenances; and grooved joints.

3.3 VALVE APPLICATIONS

A. General Application: Use mechanical-joint-end valves for NPS 3 and larger underground installation. Use threaded-or flanged-end valves for installation in vaults. Use UL/FMG, nonrising-stem gate valves for installation with indicator posts. Use corporation valves and curb valves with ends compatible with piping, for NPS 2 and smaller installation.

B. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
1. Underground Valves, NPS 3 and Larger: AWWA, cast-iron, nonrising-stem, resilient-seated gate valves with valve box.
2. Underground Valves, NPS 4 and Larger, for Indicator Posts: UL/FMG, cast-iron, nonrising-stem gate valves with indicator post.
3. Use the following for valves in vaults and aboveground:
   a. Gate Valves, NPS 2 and Smaller: Bronze, nonrising stem.
   b. Gate Valves, NPS 3 and Larger: AWWA, cast iron, OS&Y rising stem, metal seated.
   c. Check Valves: AWWA C508, swing type.
4. Detector Check Valves: Use for water-service piping in vaults and aboveground to detect unauthorized use of water.

3.4 PIPING SYSTEMS -COMMON REQUIREMENTS

A. See Division 2 Section "Piped Utilities -Basic Materials and Methods" for piping-system common requirements.

3.5 PIPING INSTALLATION

A. Water-Main Connection: Tap water main according to requirements of water utility company and of size and in location indicated.

B. Make connections larger than NPS 1.5 with tapping machine according to the following:
1. Install tapping sleeve and tapping valve according to MSS SP-60.
2. Install tapping sleeve on pipe to be tapped. Position flanged outlet for gate valve.
3. Use tapping machine compatible with valve and tapping sleeve; cut hole in main. Remove tapping machine and connect water-service piping.
4. Install gate valve onto tapping sleeve. Comply with MSS SP-60. Install valve with stem pointing up and with valve box.

C. Make connections NPS 1.5 and smaller with drilling machine according to the following:
1. Install service-saddle assemblies and corporation valves in size, quantity, and arrangement required by utility company standards.
2. Install service-saddle assemblies on water-service pipe to be tapped. Position outlets for corporation valves.
3. Use drilling machine compatible with service-saddle assemblies and corporation valves. Drill hole in main. Remove drilling machine and connect water-service piping.
4. Install corporation valves into service-saddle assemblies.
5. Install manifold for multiple taps in water main.
6. Install curb valve in water-service piping with head pointing up and with service box.

D. Comply with NFPA 24 for fire-service-main piping materials and installation.
1. Install PE corrosion-protection encasement according to ASTM A 674 or AWWA C105.
2. Install copper tube and fittings according to CDA's "Copper Tube Handbook."

E. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.
1. Install PE corrosion-protection encasement according to ASTM A 674 or AWWA C105.

F. Bury piping with depth of cover over top at least 36 inches, with top at least 12 inches below level of maximum frost penetration, and according to the following:
1. Under Driveways: With at least 36 inches cover over top.
2. Under Railroad Tracks: With at least 48 inches cover over top.
3. In Loose Gravelly Soil and Rock: With at least 12-inches additional cover.

G. Install piping by tunneling or jacking, or combination of both, under streets and other obstructions that cannot be disturbed.

H. Extend water-service piping and connect to water-supply source and building-water-piping systems at outside face of building wall in locations and pipe sizes indicated.
1. Terminate water-service piping at building wall until building-water-piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building-water-piping systems when those systems are installed.

I. Mechanical sleeve seals are specified in Division 15 Section "Basic Mechanical Materials and Methods."

J. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.

K. See Division 13 Section "Fire-Suppression Piping" for fire-suppression-water piping inside the building.

L. See Division 15 Section "Domestic Water Piping" for potable-water piping inside the building.

3.6 JOINT CONSTRUCTION

A. See Division 2 Section "Piped Utilities -Basic Materials and Methods" for basic piping joint construction.

B. Make pipe joints according to the following:
1. Copper-Tubing, Pressure-Sealed Joints: Use proprietary crimping tool and procedure recommended by copper, pressure-seal-fitting manufacturer.
2. Ductile-Iron Piping, Gasketed Joints for Water-Service Piping: AWWA C600 and AWWA M41.
3. Ductile-Iron Piping, Gasketed Joints for Fire-Service-Main Piping: UL 194.
4. Ductile-Iron Piping, Grooved Joints: Cut-groove pipe. Assemble joints with grooved-end, ductile-iron-piping couplings, gaskets, lubricant, and bolts according to coupling manufacturer's written instructions.

3.7 ANCHORAGE INSTALLATION

A. Anchorage, General: Install water-distribution piping with restrained joints. Anchorages and restrained-joint types that may be used include the following:
1. Concrete thrust blocks.
2. Locking mechanical joints.
3. Set-screw mechanical retainer glands.
4. Bolted flanged joints.
5. Pipe clamps and tie rods.

B. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for the following piping systems:
1. Gasketed-Joint, Ductile-Iron, Water-Service Piping: According to AWWA C600.
2. Gasketed-Joint, PVC Water-Service Piping: According to AWWA M23.
3. Fire-Service-Main Piping: According to NFPA 24.

C. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

3.8 VALVE INSTALLATION

A. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.

B. AWWA Valves Other Than Gate Valves: Comply with AWWA C600 and AWWA M44.

C. Corporation Valves and Curb Valves: Install each underground curb valve with head pointed up and with service box.

3.9 DETECTOR-CHECK VALVE INSTALLATION

A. Install in vault or aboveground.

B. Install for proper direction of flow. Install bypass with water meter, gate valves on each side of meter, and check valve downstream from meter.

C. Support detector check valves, meters, shutoff valves, and piping on brick or concrete piers.

3.10 WATER METER INSTALLATION

A. Install water meters, piping, and specialties according to utility company's written instructions.

3.11 ROUGHING-IN FOR WATER METERS

A. Rough-in piping and specialties for water meter installation according to utility company's written instructions.

3.12 BACKFLOW PREVENTER INSTALLATION

A. Install backflow preventers of type, size, and capacity indicated. Include valves and test cocks. Install according to requirements of plumbing and health department and authorities having jurisdiction.

B. Do not install backflow preventers that have relief drain in vault or in other spaces subject to flooding.

C. Do not install bypass piping around backflow preventers.

D. Support NPS 2-1/2 and larger backflow preventers, valves, and piping near floor and on brick or concrete piers.

E. Install RPZ backflow preventer per MWWSSB and manufacturers requirements.

3.13 WATER METER BOX INSTALLATION

A. Install water meter boxes in paved areas flush with surface.

B. Install water meter boxes in grass or earth areas with top 2 inches above surface.

3.14 CONCRETE VAULT INSTALLATION

A. Install precast concrete vaults according to ASTM C 891.

3.15 PROTECTIVE ENCLOSURE INSTALLATION

A. Install concrete base level and with top approximately 2 inches above grade.

B. Install protective enclosure over valves and equipment.

C. Anchor protective enclosure to concrete base.

3.16 FIRE HYDRANT INSTALLATION

A. General: Install each fire hydrant with separate gate valve in supply pipe, anchor with restrained joints or thrust blocks, and support in upright position.

B. AWWA Fire Hydrants: Comply with AWWA M17.

3.17 FIRE DEPARTMENT CONNECTION INSTALLATION

A. Install ball drip valves at each check valve for fire department connection to mains.

B. Install protective pipe bollards on two sides of each fire department connection. Pipe bollards are specified in Division 5 Section "Metal Fabrications."

3.18 ALARM DEVICE INSTALLATION

A. Coordinate all alarm system components with AU and the Vortex Fire Department.

B. General: Comply with NFPA 24 for devices and methods of valve supervision. Underground valves with valve box do not require supervision.

C. Supervisory Switches: Supervise valves in open position.
1. Valves: Grind away portion of exposed valve stem. Bolt switch, with plunger in stem depression, to OS&Y gate-valve yoke.
2. Indicator Posts: Drill and thread hole in upper-barrel section at target plate. Install switch, with toggle against target plate, on barrel of indicator post.

D. Locking and Sealing: Secure unsupervised valves as follows:
1. Valves: Install chain and padlock on open OS&Y gate valve.
2. Post Indicators: Install padlock on wrench on indicator post.

E. Pressure Switches: Drill and thread hole in exposed barrel of fire hydrant. Install switch.

F. Water-Flow Indicators: Install in water-service piping in vault. Select indicator with saddle and vane matching pipe size. Drill hole in pipe, insert vane, and bolt saddle to pipe.

G. Connect alarm devices to building fire alarm system. Wiring and fire-alarm devices are specified in Division 13 Section "Fire Alarm."

3.19 CONNECTIONS

A. Piping installation requirements are specified in other Division 2 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. See Division 2 Section "Piped Utilities -Basic Materials and Methods" for piping connections to valves and equipment.

C. Connect water-distribution piping to utility water main. Use tapping sleeve and tapping valve.

D. Connect water-distribution piping to interior domestic water piping.

E. Connect waste piping from concrete vault drains to storm-drainage system. See Division 2 Section "Storm Drainage" for connection to storm-sewer piping.

F. Ground equipment according to Division 16 Section "Grounding and Bonding."

G. Connect wiring according to Division 16 Section "Conductors and Cables."

3.20 FIELD QUALITY CONTROL

A. Piping Tests: Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.

B. Hydrostatic Tests: Test at not less than one-and-one-half times working pressure for two hours.

1. Increase pressure in 50-psig increments and inspect each joint between increments. Hold at test pressure for 1 hour; decrease to 0 psig. Slowly increase again to test pressure and hold for 1 more hour. Maximum allowable leakage is 2 quarts per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.

C. Prepare reports of testing activities.

3.21 IDENTIFICATION

A. Install continuous underground detectable warning tape during backfilling of trench for underground water-distribution piping. Locate below finished grade, directly over piping. Underground warning tapes are specified in Division 2 Section "Earthwork."

B. Permanently attach equipment nameplate or marker indicating plastic water-service piping, on main electrical meter panel. See Division 2 Section "Piped Utilities -Basic Materials and Methods" for identifying devices.

3.22 CLEANING

A. Clean and disinfect water-distribution piping as follows:
   1. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.
   2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or do as follows:
      a. Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine; isolate and allow to stand for 3 hours.
      b. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.
      c. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.

B. Prepare reports of purging and disinfecting activities.

END OF SECTION 02510

SECTION 02525 - SANITARY SEWERAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Vortex Building Design and Construction Guidelines (Latest Edition)

1.2 SUMMARY

A. Section Includes:
1. Pipe and fittings.
2. Nonpressure and pressure couplings.
3. Cleanouts.
4. Encasement for piping.
5. Manholes.

1.3 SUBMITTALS

A. Shop Drawings: For manholes. Include plans, elevations, sections, details, and frames and covers.

B. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from sewer system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.

C. Field quality-control reports.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect pipe, pipe fittings, and seals from dirt and damage.

B. Handle manholes according to manufacturer's written rigging instructions.

1.5 PROJECT CONDITIONS

A. Interruption of Existing Sanitary Sewerage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
1. Notify Construction Manager no fewer than two days in advance of proposed interruption of service.
2. Do not proceed with interruption of service without Construction Manager's written permission.

PART 2 - PRODUCTS

2.1 DUCTILE-IRON, GRAVITY SEWER PIPE AND FITTINGS

A. Pipe: ASTM A 746, for push-on joints.

B. Standard Fittings: AWWA C110, ductile or gray iron, for push-on joints.

C. Compact Fittings: AWWA C153, ductile iron, for push-on joints.

D. Gaskets: AWWA C111, rubber.

E. Lining: AWWA C151, Asphaltic.

F. Allowable manufacturers: American, U.S. Pipe and Foundry and Griffin

2.2 CLEANOUTS

A. Cast-Iron Cleanouts:
1. Top-Loading Classification(s): Heavy Duty and Extra-Heavy Duty.
2. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

2.3 ENCASEMENT FOR PIPING

A. Standard: ASTM A 674 or AWWA C105.

B. Material: high-density, cross-laminated polyethylene film of 0.004-inch (0.10-mm) minimum thickness.

C. Form: Sheet or tube.

D. Color: Black.

2.4 MANHOLES

A. Standard Precast Concrete Manholes:
1. Description: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
2. Diameter: 48 inches minimum unless otherwise indicated.
3. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.
4. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section; with separate base slab or base section with integral floor.
5. Riser Sections: 4-inch minimum thickness, of length to provide depth indicated.
6. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated; with top of cone of size that matches grade rings.
7. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
8. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
9. Steps: Individual FRP steps or FRP ladder; wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches.

10. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, with diameter matching manhole frame and cover, and with height as required to adjust manhole frame and cover to indicated elevation and slope.
11. Manhole Frames and Covers:
    a. Description: Ferrous; 24-inch ID by 7- to 9-inch riser, with 4-inch- minimum- width flange and 26-inch- diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "SANITARY SEWER."
    b. Material: ASTM A 536, Grade 60-40-18 ductile iron unless otherwise indicated.

2.5 CONCRETE

A. General: Cast-in-place concrete complying with ACI 318, ACI 350/350R, and the following:
1. Cement: ASTM C 150, Type II.
2. Fine Aggregate: ASTM C 33, sand.
3. Coarse Aggregate: ASTM C 33, crushed gravel.
4. Water: Potable.
5. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio.
    a. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.
    b. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.
6. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio. Include channels and benches in manholes.
    a. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.
        1) Invert Slope: 2 percent through manhole.
    b. Benches: Concrete, sloped to drain into channel.
        1) Slope: 8 percent.
7. Ballast and Pipe Supports: Portland cement design mix, 3000 psi minimum, with 0.58 maximum water/cementitious materials ratio.
    a. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.
    b. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Division 2 Section "Earthwork."

3.2 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground sanitary sewer piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.

C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.

F. Install gravity-flow, nonpressure, drainage piping according to the following:
1. Install piping pitched down in direction of flow, at minimum slope of 1 percent unless otherwise indicated.
2. Install piping NPS 6 and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place-concrete supports or anchors.
3. Install piping with 36-inch minimum cover.
4. Install ductile-iron, gravity sewer piping according to ASTM A 746.
5. Install corrosion-protection piping encasement over the following underground metal piping according to ASTM A 674 or AWWA C105:
   a. Ductile-iron pipe and fittings.
6. Clear interior of piping and manholes of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed. Place plug in end of incomplete piping at end of day and when work stops.

3.3 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, nonpressure, drainage piping according to the following:
   1. Join ductile-iron, gravity sewer piping according to AWWA C600 for push-on joints.

3.4 MANHOLE INSTALLATION

A. General: Install manholes complete with appurtenances and accessories indicated.

B. Install precast concrete manhole sections with sealants according to ASTM C 891.

C. Install FRP manholes according to manufacturer's written instructions.

D. Form continuous concrete channels and benches between inlets and outlet.

E. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 3 inches above finished surface elsewhere unless otherwise indicated.

F. Install manhole-cover inserts in frame and immediately below cover.

3.5 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318.

3.6 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts, and use cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.

1. Use Heavy-Duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.
2. Use Heavy-Duty, top-loading classification cleanouts in paved foot-traffic areas.
3. Use Heavy-Duty, top-loading classification cleanouts in vehicle-traffic service areas.
4. Use Extra-Heavy-Duty, top-loading classification cleanouts in roads.
5. Set cleanout frames and covers in earth in cast-in-place-concrete block, 18 by 18 by 12 inches deep. Set with tops 1 inch above surrounding grade.
6. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.7 CONNECTIONS

A. Connect nonpressure, gravity-flow drainage piping to building's sanitary building drains specified in Division 15 Section "Sanitary Waste and Vent Piping."

B. Connect force-main piping to building's sanitary force mains specified in Division 15 Section "Sanitary Waste and Vent Piping." Terminate piping where indicated.

C. Make connections to existing piping and underground manholes.

1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye fitting plus 6-inch overlap with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
2. Make branch connections from side into existing piping, NPS 4 to NPS 20. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
3. Make branch connections from side into existing piping, NPS 21 or larger, or to underground manholes by cutting opening into existing unit large enough to allow 3 inches of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of pipe or manhole wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground.
    a. Use concrete that will attain a minimum 28-day compressive strength of 3000 psi unless otherwise indicated.
    b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.
    c. Protect existing piping and manholes to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

3.8 CLOSING ABANDONED SANITARY SEWER SYSTEMS

A. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either procedure below:

1. Close open ends of piping with at least 8-inch- thick, brick masonry bulkheads.
2. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.
3. Abandoned Manholes: Excavate around manhole as required and use either procedure below:
    a. Remove manhole and close open ends of remaining piping.
    b. Remove top of manhole down to at least 36 inches below final grade. Fill to within 12 inches of top with stone, rubble, gravel, or compacted dirt. Fill to top with concrete.
4. Backfill to grade according to Division 2 Section "Earthwork."

3.9 IDENTIFICATION

A. Materials and their installation are specified in Division 2 Section "Earthwork." Arrange for installation of green warning tapes directly over piping and at outside edges of underground manholes.

1. Use detectable warning tape over ferrous piping.
2. Use detectable warning tape over nonferrous piping and over edges of underground manholes.

3.10 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.

1. Submit separate report for each system inspection.
2. Defects requiring correction include the following:
    a. Alignment: Less than full diameter of inside of pipe is visible between structures.
    b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
    c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
    d. Infiltration: Water leakage into piping.
    e. Exfiltration: Water leakage from or around piping.
    f. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
    g. Reinspect and repeat procedure until results are satisfactory.
3. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
    a. Do not enclose, cover, or put into service before inspection and approval.
    b. Test completed piping systems according to requirements of authorities having jurisdiction.
    c. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
    d. Submit separate report for each test.
4. Leaks and loss in test pressure constitute defects that must be repaired.
5. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

6. MANHOLE TESTING:

a. All new manholes shall be tested by the Contractor using the vacuum test method, following the manufacturer's recommendations for proper and safe procedures.

b. Any leakage in the manhole or structure, before, during, or after the test shall be repaired.

c. All pipes for vacuum testing entering the manhole shall be installed at the top access point of the manhole.

d. A vacuum of 10 inches of mercury (Hg) (5.0 psi) shall be drawn on the manhole, and the time shall be measured for the vacuum to drop to 9 inches of mercury (Hg) (4.5).

e. Manholes will be considered to have failed the vacuum test if the time to drop 1 inch of mercury is less than what is shown in the following table:

f. VACUUM TEST TIMETABLE Manhole Diameter

Depth (ft.)	48 inches	60 inches	72 inches	96 inches
4	10 sec.	13 sec.	16 sec.	19 sec.
8	20 sec.	26 sec.	32 sec.	38 sec.
12	30 sec.	39 sec.	48 sec.	57 sec.
16	40 sec.	52 sec.	64 sec.	76 sec.
20	50 sec.	65 sec.	80 sec.	95 sec.
+ Each 2 ft.	+ 5 sec.	+ 6.5 sec.	+ 8 sec.	+9.5 sec.

7. PIPELINE TESTING

a. All pipelines shall be tested in accordance with procedures and practices applicable to the various types and kinds of pipe and to the various sizes of pipe. The Contractor is reminded that personnel not experienced in testing procedures and practices, and particularly in air-testing of pipelines, should neither be allowed to conduct the test nor assist in the test procedures.

8. Testing Gravity Sewers:

a. The total quantity of infiltration into the sewer (including manholes) shall not exceed 50 gallons per mile of sewer per inch of inside diameter per 24 hours and in no case shall it exceed 2,500 gallons per mile per 24 hours. Regardless of the amount of infiltration leakage which occurs, the Contractor shall repair and correct any and all visible or audible leaks in any section of the sewer, manholes, or appurtenances.

b. In order that final testing of the sewers not be deferred until the sewers are operating under 'wet weather' and high water table conditions, and that surface restoration work can closely follow construction work, the Contractor shall employ the "low-pressure air testing procedure" in order to determine the probable acceptability of the sewers as reasonably watertight conduits (within the limits specified) when operating under 'wet weather' and high water table conditions.

c. Sewers of sizes up to and including 24" in diameter shall be tested by use of the Low-Pressure Air Test of Sewer Lines, ASTM C828, latest revision.

d. The "low-pressure air test" shall generally conform to the hereinafter outlined procedure, recommended by the National Clay Pipe Institute for testing sanitary sewers.

1) Clean pipe to be tested. For small diameter sewers, this may be done by "balling" the line, that is, utilizing water pressure for propelling a rubber ball through the sewer; and, in the case of larger diameter sewers, the Contractor may elect to employ interior cleaning crews. A wetted interior pipe surface will be advantageous in securing more consistent results.

2) Pug all open ends and pipe outlets with suitable test plugs, and brace each plug securely. Brace all plugged fittings and plugged service lines to prevent blow-out of plug.

3) If the pipe to be tested is subject to external pressure exerted by elevation of ground water table, the elevation of ground water table (with reference to invert of sewer) shall be determined. This may be done by either of the following methods:

(a) Insert a pipe probe through backfill to elevation of invert by boring or jetting. Equip top end of probe with a bubbler head. Slowly pass air through bubbler head and probe. Read pressure from air gauge mounted on bubbler head. All base gage pressures specified for the test shall be increased by gage reading. Gage shall be low-pressure, wide range.

(b) Install ½ inch diameter pipe through manhole wall at level approximately at top of sewer; turn down pipe outside of manhole to run to elevation of invert; and cap pipe inside of manhole. This should be done at the time when the manhole is constructed. When the line is to be tested remove cap, clear test pipe with compressed air, and connect clear plastic tube to test pipe. Start flow of water through pipe and tube, and read elevation of water in tube (with reference to invert of pipe). Divide reading by 2.31 and add resulting to invert of pipe). Divide reading by 2.31 and add resulting pressure (in psi) to add base gage pressures specified for the test. After all testing has been completed cap or plug test pipe at manhole wall.

(1) Add air slowly to the plugged section of the sewer under test until the internal air pressure has been raised to 4.0 psig base plus any pressure allowance representing external head as determined under 3 hereinabove. After the pre-set pressure (4.0 psig base + allowance) has been obtained, allow at least two minutes for air temperature to stabilize, adding only the amount of air required to maintain the pre-set pressure, then close air supply valve.

(2) When the pressure decreased to a gage reading equal to 3.5 psig base + allowance (such gage reading being termed stabilized pressure), start stop-watch. Determine time in seconds marking drop of 1.0 psig of internal air pressure.

(3) Refer to the AIR TEST TABLE following this Section to determine minimum permissible pressure holding time in seconds for particular section of sewer being tested.

e. The Contractor shall be responsible for observance of all safety precautions and maintenance of safe conditions during air testing.

1) These precautions shall include but not be limited to ensuring that personnel not experienced in air testing procedure not be allowed to conduct the air tests and that personnel are not allowed in the manholes at ends of test sections during tests.

2) Pneumatic plugs shall be seal tested in pipe sections outside of trench before being used to plug sewers; and such test sections shall be internally pressurized to levels adequate to determine sealing efficiency of plugs.

3) Air supply lines to pneumatic plugs and to sealed section shall be equipped with pressure regulating sets. Return line from sealed section shall be equipped with pressure gage to monitor pressure rise in sealed section.

4) AIR TEST TABLES*

5) MINIMUM HOLDING TIME IN SECONDS
REQUIRED FOR PRESSURE TO DROP FROM 3½ TO 2½ PSIG

	PIPE SIZE													
LF	4"	6"	8"	10"	12"	15"	18"	21"	24"	27"	30"	33"	36"	39"
25	4	10	18	28	40	62	89	121	158	200	248	299	356	418
50	9	20	35	55	79	124	178	243	317	401	495	599	713	837
75	13	30	53	83	119	186	267	364	475	601	743	898	1020	1105
100	18	40	70	110	158	248	356	485	634	765	851	935		
125	22	50	88	138	198	309	446	595	680					
150	26	59	106	165	238	371	510							
175	31	69	123	193	277	425								
200	35	79	141	220	317									
225	40	89	158	248	340									
250	44	99	176	275										
275	48	109	194	283										
300	53	119	211											
350	62	139	227											
400	70	158												
450	70	170												
500	88													
550	70													
600	106													

END OF SECTION 02525

SECTION 02530 - SANITARY SEWERAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Vortex Water Works and Sanitary Sewer Board Standards and Specifications.

1.2 SUMMARY

A. Section Includes:
1. Pipe and fittings.
2. Nonpressure and pressure couplings.
3. Cleanouts.
4. Encasement for piping.
5. Manholes.

1.3 SUBMITTALS

A. Shop Drawings: For manholes. Include plans, elevations, sections, details, and frames and covers.

B. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from sewer system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.

C. Field quality-control reports.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect pipe, pipe fittings, and seals from dirt and damage.

B. Handle manholes according to manufacturer's written rigging instructions.

1.5 PROJECT CONDITIONS

A. Interruption of Existing Sanitary Sewerage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
1. Notify Construction Manager no fewer than two days in advance of proposed interruption of service.
2. Do not proceed with interruption of service without Construction Manager's written permission.

PART 2 - PRODUCTS

2.1 PVC PIPE AND FITTINGS

A. Pipe: SDT 23.5 per ASTM D 3034.

2.2 CLEANOUTS

A. Cast-Iron Cleanouts:
1. Top-Loading Classification(s): Heavy Duty and Extra-Heavy Duty.
2. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

2.3 ENCASEMENT FOR PIPING

A. Standard: ASTM A 674 or AWWA C105.

B. Material: high-density, cross-laminated polyethylene film of 0.004-inch (0.10-mm) minimum thickness.

C. Form: Sheet or tube.

D. Color: Black.

2.4 MANHOLES

A. Standard Precast Concrete Manholes:
1. Description: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
2. Diameter: 48 inches minimum unless otherwise indicated.
3. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.
4. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section; with separate base slab or base section with integral floor.
5. Riser Sections: 4-inch minimum thickness, of length to provide depth indicated.
6. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated; with top of cone of size that matches grade rings.
7. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
8. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
9. Steps: Individual FRP steps or FRP ladder; wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12-to 16-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches.
10. Grade Rings: Reinforced-concrete rings, 6-to 9-inch total thickness, with diameter matching manhole frame and cover, and with height as required to adjust manhole frame and cover to indicated elevation and slope.

B. Manhole Frames and Covers:
1. Description: Ferrous; 24-inch ID by 7-to 9-inch riser, with 4-inch-minimum-width flange and 26-inch-diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "SANITARY SEWER."
2. Material: ASTM A 536, Grade 60-40-18 ductile iron unless otherwise indicated.

2.5 CONCRETE

A. General: Cast-in-place concrete complying with ACI 318, ACI 350/350R, and the following:
1. Cement: ASTM C 150, Type II.
2. Fine Aggregate: ASTM C 33, sand.
3. Coarse Aggregate: ASTM C 33, crushed gravel.
4. Water: Potable.

B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio.
1. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.

C. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio. Include channels and benches in manholes.
1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.
a. Invert Slope: 2 percent through manhole.
2. Benches: Concrete, sloped to drain into channel.
a. Slope: 8 percent.

D. Ballast and Pipe Supports: Portland cement design mix, 3000 psi minimum, with 0.58 maximum water/cementitious materials ratio.
1. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Division 2 Section "Earthwork."

3.2 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground sanitary sewer piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.

C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process ofmicrotunneling.

F. Install gravity-flow, nonpressure, drainage piping according to the following:
1. Install piping pitched down in direction of flow, at minimum slope of 1 percent unless otherwise indicated.
2. Install piping NPS 6 and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place-concrete supports or anchors.
3. Install piping with 36-inch minimum cover.
4. Install ductile-iron, gravity sewer piping according to ASTM A 746.

G. Clear interior of piping and manholes of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed. Place plug in end of incomplete piping at end of day and when work stops.

3.3 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, nonpressure, drainage piping according to the following:
1. Join ductile-iron, gravity sewer piping according to AWWA C600 for push-on joints.

B. Join PVC piping fittings according to AWWA ML3

3.4 MANHOLE INSTALLATION

A. General: Install manholes complete with appurtenances and accessories indicated.

B. Install precast concrete manhole sections with sealants according to ASTM C 891.

C. Install FRP manholes according to manufacturer's written instructions.

D. Form continuous concrete channels and benches between inlets and outlet.

E. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 3 inches above finished surface elsewhere unless otherwise indicated.

F. Install manhole-cover inserts in frame and immediately below cover.

3.5 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318.

3.6 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts, and use cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.
1. Use Heavy-Duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.
2. Use Heavy-Duty, top-loading classification cleanouts in paved foot-traffic areas.

3. Use Heavy-Duty, top-loading classification cleanouts in vehicle-traffic service areas.
4. Use Extra-Heavy-Duty, top-loading classification cleanouts in roads.

B. Set cleanout frames and covers in earth in cast-in-place-concrete block, 18 by 18 by 12 inches deep. Set with tops 1 inch above surrounding grade.

C. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.7 CONNECTIONS

A. Connect nonpressure, gravity-flow drainage piping to building's sanitary building drains specified in Division 15 Section "Sanitary Waste and Vent Piping."

B. Connect force-main piping to building's sanitary force mains specified in Division 15 Section "Sanitary Waste and Vent Piping." Terminate piping where indicated.

C. Make connections to existing piping and underground manholes.
1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye fitting plus 6-inch overlap with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
2. Make branch connections from side into existing piping, NPS 4 to NPS 20. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
3. Make branch connections from side into existing piping, NPS 21 or larger, or to underground manholes by cutting opening into existing unit large enough to allow 3 inches of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of pipe or manhole wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground.
    a. Use concrete that will attain a minimum 28-day compressive strength of 3000 psi unless otherwise indicated.
    b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.
4. Protect existing piping and manholes to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

3.8 CLOSING ABANDONED SANITARY SEWER SYSTEMS

A. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either procedure below:
1. Close open ends of piping with at least 8-inch-thick, brick masonry bulkheads.
2. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.

B. Abandoned Manholes: Excavate around manhole as required and use either procedure below:
1. Remove manhole and close open ends of remaining piping.
2. Remove top of manhole down to at least 36 inches below final grade. Fill to within 12 inches of top with stone, rubble, gravel, or compacted dirt. Fill to top with concrete.

C. Backfill to grade according to Division 2 Section "Earthwork."

3.9 IDENTIFICATION

A. Materials and their installation are specified in Division 2 Section "Earthwork." Arrange for installation of green warning tapes directly over piping and at outside edges of underground manholes.
1. Use detectable warning tape over ferrous piping.
2. Use detectable warning tape over nonferrous piping and over edges of underground manholes.

3.10 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
1. Submit separate report for each system inspection.
2. Defects requiring correction include the following:
a. Alignment: Less than full diameter of inside of pipe is visible between structures.
b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
d. Infiltration: Water leakage into piping.
e. Exfiltration: Water leakage from or around piping.
3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Reinspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
1. Do not enclose, cover, or put into service before inspection and approval.
2. Test completed piping systems according to requirements of authorities having jurisdiction.
3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
4. Submit separate report for each test.
5. Air Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
6. Manholes: Perform hydraulic test according to ASTM C 969.

C. Leaks and loss in test pressure constitute defects that must be repaired.

D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.11 CLEANING

A. Clean dirt and superfluous material from interior of piping. Flush with potable water.

END OF SECTION

SECTION 02625 - SUBDRAINAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Perforated-wall pipe and fittings.
2. Drainage conduits.
3. Drainage panels.
4. Geotextile filter fabrics.

1.3 ACTION SUBMITTALS

A. Product Data:
1. Drainage conduits, including rated capacities.
2. Drainage panels, including rated capacities.
3. Geotextile filter fabrics. PART 2 - PRODUCTS

2.1 PERFORATED-WALL PIPES AND FITTINGS

A. Perforated PE Pipe and Fittings:
1. NPS 6 and Smaller: ASTM F 405 or AASHTO M 252, Type CP; corrugated, for coupled joints.
2. NPS 8 and Larger: ASTM F 667; AASHTO M 252, Type CP; or AASHTO M 294, Type CP; corrugated; for coupled joints.
3. Couplings: Manufacturer's standard, band type.

B. Perforated PVC Sewer Pipe and Fittings: ASTM D 2729, bell-and-spigot ends, for loose joints.

2.2 SOIL MATERIALS

A. Soil materials are specified in Section 02300 "Earthwork."

2.3 GEOTEXTILE FILTER FABRICS

A. Description: Fabric of PP or polyester fibers or combination of both, with flow rate range from 110 to 330 gpm/sq. ft. when tested according to ASTM D 4491.

B. Structure Type: Nonwoven, needle-punched continuous filament.
1. Survivability: AASHTO M 288 Class 2.
2. Styles: Flat and sock.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces and areas for suitable conditions where subdrainage systems are to be installed.

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

3.2 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Section 02300 "Earthwork."

3.3 FOUNDATION DRAINAGE INSTALLATION

A. Place impervious fill material on subgrade adjacent to bottom of footing after concrete footing forms have been removed. Place and compact impervious fill to dimensions indicated, but not less than 6 inches deep and 12 inches wide.

B. Lay flat-style geotextile filter fabric in trench and overlap trench sides.

C. Place supporting layer of drainage course over compacted subgrade and geotextile filter fabric, to compacted depth of not less than 4 inches.

D. Encase pipe with sock-style geotextile filter fabric before installing pipe. Connect sock sections with adhesive or tape.

E. Install drainage piping as indicated in Part 3 "Piping Installation" Article for foundation subdrainage.

F. Add drainage course to width of at least 6 inches on side away from wall and to top of pipe to perform tests.

G. After satisfactory testing, cover drainage piping to width of at least 6 inches on side away from footing and above top of pipe to within 12 inches of finish grade.

H. Install drainage course and wrap top of drainage course with flat-style geotextile filter fabric.

I. Place layer of flat-style geotextile filter fabric over top of drainage course, overlapping edges at least 4 inches.

J. Place backfill material over compacted drainage course. Place material in loose-depth layers not exceeding 6 inches. Thoroughly compact each layer. Final backfill to finish elevations and slope away from building.

3.4 UNDERSLAB DRAINAGE INSTALLATION

A. Excavate for underslab drainage system after subgrade material has been compacted but before drainage course has been placed. Include horizontal distance of at least 6 inches between drainage pipe and trench walls. Grade bottom of trench excavations to required slope, and compact to firm, solid bed for drainage system.

B. Lay flat-style geotextile filter fabric in trench and overlap trench sides.

C. Place supporting layer of drainage course over compacted subgrade and geotextile filter fabric, to compacted depth of not less than 4 inches.

D. Encase pipe with sock-style geotextile filter fabric before installing pipe. Connect sock sections with adhesive or tape.

E. Install drainage piping as indicated in Part 3 "Piping Installation" Article for underslab subdrainage.

F. Add drainage course to width of at least 6 inches on side away from wall and to top of pipe to perform tests.

G. After satisfactory testing, cover drainage piping with drainage course to elevation of bottom of slab, and compact and wrap top of drainage course with flat-style geotextile filter fabric.

3.5 RETAINING-WALL DRAINAGE INSTALLATION

A. Lay flat-style geotextile filter fabric in trench and overlap trench sides.

B. Place supporting layer of drainage course over compacted subgrade to compacted depth of not less than 4 inches.

C. Encase pipe with sock-style geotextile filter fabric before installing pipe. Connect sock sections with adhesive or tape.

D. Install drainage piping as indicated in Part 3 "Piping Installation" Article for retaining-wall subdrainage.

E. Add drainage course to width of at least 6 inches on side away from wall and to top of pipe to perform tests.

F. After satisfactory testing, cover drainage piping to width of at least 6 inches on side away from footing and above top of pipe to within 12 inches of finish grade.

G. Place drainage course in layers not exceeding 3 inches in loose depth; compact each layer placed and wrap top of drainage course with flat-style geotextile filter fabric.

H. Place layer of flat-style geotextile filter fabric over top of drainage course, overlapping edges at least 4 inches.

I. Fill to Grade: Place satisfactory soil fill material over compacted drainage course. Place material in loose-depth layers not exceeding 6 inches. Thoroughly compact each layer. Fill to finish grade.

3.6 LANDSCAPING DRAINAGE INSTALLATION

A. Provide trench width to allow installation of drainage conduit. Grade bottom of trench excavations to required slope, and compact to firm, solid bed for drainage system.

B. Lay flat-style geotextile filter fabric in trench and overlap trench sides.

C. Place supporting layer of drainage course over compacted subgrade and geotextile filter fabric, to compacted depth of not less than 4 inches.

D. Install drainage conduits as indicated in Part 3 "Piping Installation" Article for landscaping subdrainage with horizontal distance of at least 6 inches between conduit and trench walls. Wrap drainage conduits without integral geotextile filter fabric with flat-style geotextile filter fabric before installation. Connect fabric sections with adhesive or tape.

E. Add drainage course to top of drainage conduits.

F. After satisfactory testing, cover drainage conduit to within 12 inches of finish grade.

G. Install drainage course and wrap top of drainage course with flat-style geotextile filter fabric.

H. Place layer of flat-style geotextile filter fabric over top of drainage course, overlapping edges at least 4 inches.

I. Fill to Grade: Place satisfactory soil fill material over drainage course. Place material in loose-depth layers not exceeding 6 inches. Thoroughly compact each layer. Fill to finish grade.

3.7 PIPING INSTALLATION

A. Install piping beginning at low points of system, true to grades and alignment indicated, with unbroken continuity of invert. Bed piping with full bearing in filtering material. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions and other requirements indicated.

1. Foundation Subdrainage: Install piping level and with a minimum cover of 36 inches unless otherwise indicated.
2. Underslab Subdrainage: Install piping level.
3. Retaining-Wall Subdrainage: When water discharges at end of wall into stormwater piping system, install piping level and with a minimum cover of 36 inches unless otherwise indicated.
4. Landscaping Subdrainage: Install piping pitched down in direction of flow, at a minimum slope of 0.5 percent and with a minimum cover of 36 inches unless otherwise indicated.
5. Lay perforated pipe with perforations down.

B. Use increasers, reducers, and couplings made for different sizes or materials of pipes and fittings being connected. Reduction of pipe size in direction of flow is prohibited.

3.8 PIPE JOINT CONSTRUCTION

A. Join perforated PE pipe and fittings with couplings according to ASTM D 3212 with loose banded, coupled, or push-on joints.

B. Join perforated PVC sewer pipe and fittings according to ASTM D 3212 with loose bell-and-spigot, push-on joints.

C. Special Pipe Couplings: Join piping made of different materials and dimensions with special couplings made for this application. Use couplings that are compatible with and fit materials and dimensions of both pipes.

3.9 CONNECTIONS

A. Comply with requirements for piping specified in Section 02630 "Storm Drainage." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect low elevations of subdrainage system to solid-wall-piping storm drainage system.

3.10 FIELD QUALITY CONTROL

A. Tests and Inspections:
1. After installing drainage course to top of piping, test drain piping with water to ensure free flow before backfilling.
2. Remove obstructions, replace damaged components, and repeat test until results are satisfactory.
3. See Section 01400 "Quality Requirements" for retesting and reinspecting requirements and Section 01700 "Execution Requirements" for requirements for correcting the Work.

B. Drain piping will be considered defective if it does not pass tests and inspections.

3.11 CLEANING

A. Clear interior of installed piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed. Place plugs in ends of uncompleted pipe at end of each day or when work stops.

END OF SECTION 02625

SECTION 02630 - STORM DRAINAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Pipe and fittings.
2. Nonpressure transition couplings.
3. Cleanouts.
4. Drains.
5. Encasement for piping.
6. Manholes.
7. Channel drainage systems.
8. Catch basins.
9. Stormwater inlets.
10. Stormwater detention structures.
11. Pipe outlets.
12. Dry wells.

1.3 DEFINITIONS

A. FRP: Fiberglass-reinforced plastic.

1.4 SUBMITTALS

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

B. Shop Drawings:
1. Manholes: Include plans, elevations, sections, details, frames, and covers.
2. Catch basins stormwater inlets and dry wells. Include plans, elevations, sections, details, frames, covers, and grates.
3. Stormwater Detention Structures: Include plans, elevations, sections, details, frames, covers, design calculations, and concrete design-mix reports.

C. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from storm drainage system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.

D. Product Certificates: For each type of cast-iron soil pipe and fitting, from manufacturer.

E. Field quality-control reports.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic manholes, pipe, and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

C. Handle manholes according to manufacturer's written rigging instructions.
D.
E. Handle catch basins and stormwater inlets according to manufacturer's written rigging instructions.

1.6 PROJECT CONDITIONS

A. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Construction Manager no fewer than two days in advance of proposed interruption of service.
2. Do not proceed with interruption of service without Construction Manager's written permission.

PART 2 - PRODUCTS

2.1 DUCTILE-IRON, CULVERT PIPE AND FITTINGS

A. Pipe: ASTM A 716, for push-on joints.

B. Standard Fittings: AWWA C110, ductile or gray iron, for push-on joints.

C. Compact Fittings: AWWA C153, for push-on joints.

D. Gaskets: AWWA C111, rubber.

2.2 PE PIPE AND FITTINGS

A. Corrugated PE Drainage Pipe and Fittings NPS 3 to NPS 10: AASHTO M 252M, Type S, with smooth waterway for coupling joints.

1. Silttight Couplings: PE sleeve with ASTM D 1056, Type 2, Class A, Grade 2 gasket material that mates with tube and fittings.

B. Corrugated PE Pipe and Fittings NPS 12 to NPS 60: AASHTO M 294M, Type S, with smooth waterway for coupling joints.

1. Silttight Couplings: PE sleeve with ASTM D 1056, Type 2, Class A, Grade 2 gasket material that mates with pipe and fittings.

2.3 PVC PIPE AND FITTINGS

A. PVC Cellular-Core Piping:

1. PVC Cellular-Core Pipe and Fittings: ASTM F 891, Sewer and Drain Series, PS 50 minimum stiffness, PVC cellular-core pipe with plain ends for solvent-cemented joints.
2. Fittings: ASTM D 3034, SDR 35, PVC socket-type fittings.

B. PVC Gravity Sewer Piping:
1. Pipe and Fittings: ASTM F 679, T-1 wall thickness, PVC gravity sewer pipe with bell-and-spigot ends and with integral ASTM F 477, elastomeric seals for gasketed joints.

2.4 CONCRETE PIPE AND FITTINGS

A. Nonreinforced-Concrete Sewer Pipe and Fittings: ASTM C 14, Class 3, with tongue-and groove ends and gasketed joints with ASTM C 443, rubber gaskets.

B. Reinforced-Concrete Sewer Pipe and Fittings: ASTM C 76.
1. Bell-and-spigot or tongue-and-groove ends and gasketed joints with ASTM C 443, rubber gaskets
2. Class I, Wall B.
3. Class III, Wall B.

2.5 CLEANOUTS

A. Cast-Iron Cleanouts:
1. Description: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.
2. Top-Loading Classification(s): Heavy Duty and Extra-Heavy Duty.
3. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

2.6 DRAINS

A. Cast-Iron Area Drains:
1. Description: ASME A112.6.3 gray-iron round body with anchor flange and round secured grate. Include bottom outlet with inside calk or spigot connection, of sizes indicated.
2. Top-Loading Classification(s): Heavy Duty.

B. Cast-Iron Trench Drains:
1. Description: ASME A112.6.3, 6-inch-wide top surface, rectangular body with anchor flange or other anchoring device, and rectangular secured grate. Include units of total length indicated and quantity of bottom outlets with inside calk or spigot connections, of sizes indicated.
2. Top-Loading Classification(s): Heavy and Extra-Heavy Duty.

2.7 MANHOLES

A. Standard Precast Concrete Manholes:
1. Description: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
2. Diameter: 48 inches minimum unless otherwise indicated.
3. Ballast: Increase thickness of precast concrete sections or add concrete to base section as required to prevent flotation.
4. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
5. Riser Sections: 4-inch minimum thickness, and lengths to provide depth indicated.

6. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated, and top of cone of size that matches grade rings.
7. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
8. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
9. Steps: Individual FRP steps or FRP ladder, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12-to 16-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches.
10. Grade Rings: Reinforced-concrete rings, 6-to 9-inch total thickness, to match diameter of manhole frame and cover, and height as required to adjust manhole frame and cover to indicated elevation and slope.

B. Designed Precast Concrete Manholes:
1. Description: ASTM C 913; designed according to ASTM C 890 for A-16 (AASHTO HS20-44), heavy-traffic, structural loading; of depth, shape, and dimensions indicated, with provision for sealant joints.
2. Ballast: Increase thickness of one or more precast concrete sections or add concrete to manhole as required to prevent flotation.
3. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
4. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
5. Steps: Individual FRP steps or FRP ladder, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12-to 16-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches.
6. Grade Rings: Reinforced-concrete rings, 6-to 9-inch total thickness, to match diameter of manhole frame and cover, and of height required to adjust manhole frame and cover to indicated elevation and slope.

C. Manhole Frames and Covers:
1. Description: Ferrous; 24-inch ID by 7-to 9-inch riser with 4-inch-minimum width flange and 26-inch-diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "STORM SEWER."
2. Material: ASTM A 536, Grade 60-40-18 ductile iron unless otherwise indicated.

2.8 CONCRETE

A. General: Cast-in-place concrete according to ACI 318, ACI 350/350R, and the following:
1. Cement: ASTM C 150, Type II.
2. Fine Aggregate: ASTM C 33, sand.
3. Coarse Aggregate: ASTM C 33, crushed gravel.
4. Water: Potable.

B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio.
1. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.

C. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio. Include channels and benches in manholes.

1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.
   a. Invert Slope: 2 percent through manhole.
2. Benches: Concrete, sloped to drain into channel.
   a. Slope: 8 percent.

D. Ballast and Pipe Supports: Portland cement design mix, 3000 psi minimum, with 0.58 maximum water/cementitious materials ratio.

1. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.

2.9 POLYMER-CONCRETE, CHANNEL DRAINAGE SYSTEMS

A. General Requirements for Polymer-Concrete, Channel Drainage Systems: Modular system of precast, polymer-concrete channel sections, grates, and appurtenances; designed so grates fit into channel recesses without rocking or rattling. Include quantity of units required to form total lengths indicated.

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. ABT, Inc.
2. ACO USA.

C. Sloped-Invert, Polymer-Concrete Systems:

1. Channel Sections:
   a. Interlocking-joint, precast, modular units with end caps.
   b. 4-inch inside width and deep, rounded bottom, with built-in invert slope of 0.6 percent and with outlets in quantities, sizes, and locations indicated.
   c. Extension sections necessary for required depth.
   d. Frame: Include gray-iron or steel frame for grate.
2. Grates:
   a. Manufacturer's designation "Heavy Duty," with slots or perforations that fit recesses in channels.
   b. Material: Gray iron.
3. Covers: Solid gray iron if indicated.
4. Locking Mechanism: Manufacturer's standard device for securing grates to channel sections.

2.10 CATCH BASINS

A. Standard Precast Concrete Catch Basins:

1. Description: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
2. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
3. Riser Sections: 4-inch minimum thickness, 48-inch diameter, and lengths to provide depth indicated.

4. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
5. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
6. Grade Rings: Include two or three reinforced-concrete rings, of 6-to 9-inch total thickness, that match 24-inch-diameter frame and grate.
7. Steps: Individual FRP steps or FRP ladder, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12-to 16-inch intervals. Omit steps if total depth from floor of catch basin to finished grade is less than 60 inches.
8. Pipe Connectors: ASTM C 923, resilient, of size required, for each pipe connecting to base section.

B. Designed Precast Concrete Catch Basins: ASTM C 913, precast, reinforced concrete; designed according to ASTM C 890 for A-16 (ASSHTO HS20-44), heavy-traffic, structural loading; of depth, shape, and dimensions indicated, with provision for joint sealants.
1. Joint Sealants: ASTM C 990, bitumen or butyl rubber.
2. Grade Rings: Include two or three reinforced-concrete rings, of 6-to 9-inch total thickness, that match 24-inch-diameter frame and grate.
3. Steps: Individual FRP steps or FRP ladder, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12-to 16-inch intervals. Omit steps if total depth from floor of catch basin to finished grade is less than 60 inches.
4. Pipe Connectors: ASTM C 923, resilient, of size required, for each pipe connecting to base section.

C. Frames and Grates: ASTM A 536, Grade 60-40-18, ductile iron designed for A-16, structural loading. Include flat grate with small square or short-slotted drainage openings.
1. Size: 24 by 24 inches minimum unless otherwise indicated.
2. Grate Free Area: Approximately 50 percent unless otherwise indicated.

2.11 STORMWATER INLETS

A. Curb Inlets: Made with vertical curb opening.

B. Gutter Inlets: Made with horizontal gutter opening. Include heavy-duty frames and grates.

C. Combination Inlets: Made with vertical curb and horizontal gutter openings. Include heavy- duty frames and grates.

D. Frames and Grates: Heavy duty, according to utility standards.

2.12 PIPE OUTLETS

A. Head Walls: Cast-in-place reinforced concrete, with apron and tapered sides.

B. Riprap Basins: Broken, irregularly sized and shaped, graded stone according to NSSGA's "Quarried Stone for Erosion and Sediment Control."
1. Average Size: ALDOT Class II.

C. Filter Stone: ALDOT washed # 57 Stone.

D. Energy Dissipaters: According to NSSGA's "Quarried Stone for Erosion and Sediment Control," No. A-1, 3-ton average weight armor stone, unless otherwise indicated.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavation, trenching, and backfilling are specified in Division 2 Section "Earthwork."

3.2 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.

F. Install gravity-flow, nonpressure drainage piping according to the following:

1. Install piping pitched down in direction of flow.
2. Install piping NPS 6 and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place concrete supports or anchors.
3. Install piping with 36-inch minimum cover.
4. Install ductile-iron piping and special fittings according to AWWA C600 or AWWA M41.
5. Install PE corrugated sewer piping according to ASTM D 2321.
6. Install PVC cellular-core piping according to ASTM D 2321 and ASTM F 1668.
7. Install PVC profile gravity sewer piping according to ASTM D 2321 and ASTM F 1668.
8. Install nonreinforced-concrete sewer piping according to ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."
9. Install reinforced-concrete sewer piping according to ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."

3.3 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, nonpressure drainage piping according to the following:
   1. Join ductile-iron culvert piping according to AWWA C600 for push-on joints.
   2. Join ductile-iron piping and special fittings according to AWWA C600 or AWWA M41.
   3. Join corrugated PE piping according to ASTM D 3212 for push-on joints.
   4. Join PVC cellular-core piping according to ASTM D 2321 and ASTM F 891 for solvent-cemented joints.
   5. Join PVC sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric-gasketed joints.
   6. Join PVC profile gravity sewer piping according to ASTM D 2321 for elastomeric-seal joints or ASTM F 794 for gasketed joints.
   7. Join nonreinforced-concrete sewer piping according to ASTM C 14 and ACPA's "Concrete Pipe Installation Manual" for rubber-gasketed joints.
   8. Join reinforced-concrete sewer piping according to ACPA's "Concrete Pipe Installation Manual" for rubber-gasketed joints.

3.4 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.
   1. Use Heavy-Duty, top-loading classification cleanouts in earth or unpaved foot-traffic area, foot traffic areas and vehicle traffic service areas.
   2. Use Extra-Heavy-Duty, top-loading classification cleanouts in roads.

B. Set cleanout frames and covers in earth in cast-in-place concrete block, 18 by 18 by 12 inches deep. Set with tops 1 inch above surrounding earth grade.

C. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.5 DRAIN INSTALLATION

A. Install type of drains in locations indicated.
   1. Use Heavy-Duty, top-loading classification drains in earth or unpaved foot-traffic areas.
   2. Use Heavy-Duty, top-loading classification drains in paved foot-traffic areas.
   3. Use Heavy-Duty, top-loading classification drains in vehicle-traffic service areas.
   4. Use Extra-Heavy-Duty, top-loading classification drains in roads.

B. Embed drains in 4-inch minimum concrete around bottom and sides.

C. Fasten grates to drains if indicated.

D. Set drain frames and covers with tops flush with pavement surface.

E. Assemble trench sections with flanged joints.

F. Embed trench sections in 4-inch minimum concrete around bottom and sides or as directed by the manufacturer.

3.6 MANHOLE INSTALLATION

A. General: Install manholes, complete with appurtenances and accessories indicated.

B. Install precast concrete manhole sections with sealants according to ASTM C 891.

C. Where specific manhole construction is not indicated, follow manhole manufacturer's written instructions.

D. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 3 inches above finished surface elsewhere unless otherwise indicated.

3.7 CATCH BASIN INSTALLATION

A. Construct catch basins to sizes and shapes indicated.

B. Set frames and grates to elevations indicated.

3.8 STORMWATER INLET AND OUTLET INSTALLATION

A. Construct inlet head walls, aprons, and sides of reinforced concrete, as indicated.

B. Construct riprap of broken stone, as indicated.

C. Install outlets that spill onto grade, anchored with concrete, where indicated.

D. Install outlets that spill onto grade, with flared end sections that match pipe, where indicated.

E. Construct energy dissipaters at outlets, as indicated.

3.9 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318.

3.10 CHANNEL DRAINAGE SYSTEM INSTALLATION

A. Install with top surfaces of components, except piping, flush with finished surface.

B. Assemble channel sections to form slope down toward drain outlets. Use sealants, adhesives, fasteners, and other materials recommended by system manufacturer.

C. Embed channel sections and drainage specialties in 4-inch minimum concrete around bottom and sides.

D. Fasten grates to channel sections if indicated.

E. Assemble channel sections with flanged or interlocking joints.

F. Embed channel sections in 4-inch minimum concrete around bottom and sides.

3.11 STORMWATER DISPOSAL SYSTEM INSTALLATION

A. Chamber Systems: Excavate trenches of width and depth, and install system and backfill according to chamber manufacturer's written instructions. Include storage and leaching chambers, filtering material, and filter mat.

B. Piping Systems: Excavate trenches of width and depth, and install piping system, filter fabric, and backfill, according to piping manufacturer's written instructions.

3.12 CONNECTIONS

A. Connect nonpressure, gravity-flow drainage piping in building's storm building drains specified in Division 15 Section "Storm Drainage Piping."

B. Make connections to existing piping and underground manholes.

1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting, plus 6-inch overlap, with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
2. Make branch connections from side into existing piping, NPS 4 to NPS 20. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
3. Make branch connections from side into existing piping, NPS 21 or larger, or to underground manholes and structures by cutting into existing unit and creating an opening large enough to allow 3 inches of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of pipe, manhole, or structure wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground.
    a. Use concrete that will attain a minimum 28-day compressive strength of 3000 psi unless otherwise indicated.
    b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.
4. Protect existing piping, manholes, and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.
5. Use pressure-type pipe couplings for force-main joints.

3.13 CLOSING ABANDONED STORM DRAINAGE SYSTEMS

A. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either procedure below:

1. Close open ends of piping with at least 8-inch-thick, brick masonry bulkheads.
2. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.

B. Abandoned Manholes and Structures: Excavate around manholes and structures as required and use one procedure below:

1. Remove manhole or structure and close open ends of remaining piping.
2. Remove top of manhole or structure down to at least 36 inches below final grade. Fill to within 12 inches of top with stone, rubble, gravel, or compacted dirt. Fill to top with concrete.

C. Backfill to grade according to Division 2 Section "Earthwork."

3.14 IDENTIFICATION

A. Materials and their installation are specified in Division 2 Section "Earthwork." Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.

1. Use detectable warning tape over ferrous piping.
2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

3.15 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.

1. Submit separate reports for each system inspection.
2. Defects requiring correction include the following:
   a. Alignment: Less than full diameter of inside of pipe is visible between structures.
   b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
   c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
   d. Infiltration: Water leakage into piping.
   e. Exfiltration: Water leakage from or around piping.
3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Reinspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

1. Do not enclose, cover, or put into service before inspection and approval.
2. Test completed piping systems according to requirements of authorities having jurisdiction.
3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
4. Submit separate report for each test.
5. Gravity-Flow Storm Drainage Piping: Test according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
   a. Exception: Piping with soiltight joints unless required by authorities having jurisdiction.
   b. Option: Test plastic piping according to ASTM F 1417.
   c. Option: Test concrete piping according to ASTM C 924.

C. Leaks and loss in test pressure constitute defects that must be repaired.

D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.16 CLEANING

A. Clean interior of piping of dirt and superfluous materials. Flush with water.

END OF SECTION 02630

SECTION 02745 - ASPHALT PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. ALDOT Standard Specifications for Highway Construction.

1.2 SUMMARY

A. Section Includes:
1. Cold milling of existing hot-mix asphalt pavement.
2. Hot-mix asphalt patching.
3. Hot-mix asphalt paving.
4. Hot-mix asphalt paving overlay.
5. Asphalt surface treatments.
6. Pavement-marking paint.

B. Related Sections:
1. Division 2 Sections for other paving installed as part of crosswalks in asphalt pavement areas.
2. Division 2 Section "Earthwork" for aggregate subbase and base courses and for aggregate pavement shoulders.
3. Division 2 Section "Pavement Joint Sealants" for joint sealants and fillers at paving terminations.

1.3 DEFINITION

A. Hot-Mix Asphalt Paving Terminology: Refer to ASTM D 8 for definitions of terms.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.
1. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.

B. Shop Drawings: Indicate pavement markings, lane separations, and defined parking spaces. Indicate, with international symbol of accessibility, spaces allocated for people with disabilities.

C. Samples: For each paving fabric, 12 by 12 inches minimum.

D. Samples for Verification: For the following products, in manufacturer's standard sizes unless otherwise indicated:
1. Each paving fabric, 12 by 12 inches minimum.

E. Material Certificates: For each paving material, from manufacturer.

F. Material Test Reports: For each paving material.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by authorities having jurisdiction or the DOT of state in which Project is located.

B. Testing Agency Qualifications: Qualified according to ASTM D 3666 for testing indicated.

C. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of for asphalt paving work.

1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver pavement-marking materials to Project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.

B. Store pavement-marking materials in a clean, dry, protected location within temperature range required by manufacturer. Protect stored materials from direct sunlight.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:

1. Prime Coat: Minimum surface temperature of 60 deg F.
2. Tack Coat: Minimum surface temperature of 60 deg F.
3. Slurry Coat: Comply with weather limitations in ASTM D 3910.
4. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
5. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.

B. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for oil-based materials or 55 deg F for water-based materials, and not exceeding 95 deg F.

PART 2 - PRODUCTS

2.1 AGGREGATES

A. General: Use materials and gradations that have performed satisfactorily in previous installations.

B. Coarse Aggregate: ALDOT 801.

C. Fine Aggregate: ALDOT 802.
   1. For hot-mix asphalt, limit natural sand to a maximum of 20 percent by weight of the total aggregate mass.

D. Mineral Filler: ALDOT 805.

2.2 ASPHALT MATERIALS

A. Asphalt Binder: ALDOT 424.

B. Asphalt Cement: ALDOT 804.2.

C. Prime Coat: Asphalt emulsion prime coat complying with ALDOT 401 requirements.

D. Tack Coat: ALDOT 405.

E. Water: Potable.

F. Undersealing Asphalt: ASTM D 3141, pumping consistency.

2.3 AUXILIARY MATERIALS

A. Herbicide: Commercial chemical for weed control, registered by the EPA. Provide in granular, liquid, or wettable powder form.

B. Paving Geotextile: AASHTO M 288, nonwoven polypropylene; resistant to chemical attack, rot, and mildew; and specifically designed for paving applications.

C. Joint Sealant: AASHTO M 324, Type II or III, hot-applied, single-component, polymer- modified bituminous sealant.

D. Pavement-Marking Paint: Alkyd-resin type, lead and chromate free, ready mixed, complying with AASHTO M 248, Type N; colors complying with FS TT-P-1952.
   1. Color: As indicated.

2.4 MIXES

A. Hot-Mix Asphalt: Dense, hot-laid, hot-mix asphalt plant mixes meeting the requirements of the applicable sections of ALDOT "Standard Specifications for Highway Construction" and complying with the following requirements:
   1. Provide mixes with a history of satisfactory performance in geographical area where Project is located.
   2. Base Course: ALDOT 825 B.
   3. Surface Course: ALDOT 424.
   4. Binder Course: ALDOT 424.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that subgrade is dry and in suitable condition to begin paving.

B. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction. Limit vehicle speed to 3 mph.
2. Proof roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

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

3.2 COLD MILLING

A. Clean existing pavement surface of loose and deleterious material immediately before cold milling. Remove existing asphalt pavement by cold milling to grades and cross sections indicated.

1. Mill to a depth of 2 inches.
2. Mill to a uniform finished surface free of excessive gouges, grooves, and ridges.
3. Control rate of milling to prevent tearing of existing asphalt course.
4. Repair or replace curbs, manholes, and other construction damaged during cold milling.
5. Excavate and trim unbound-aggregate base course, if encountered, and keep material separate from milled hot-mix asphalt.
6. Transport milled hot-mix asphalt to asphalt recycling facility.
7. Keep milled pavement surface free of loose material and dust.

3.3 PATCHING

A. Hot-Mix Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.

B. Tack Coat: Apply uniformly to vertical surfaces abutting or projecting into new, hot-mix asphalt paving at a rate of 0.05 to 0.15 gal./sq. yd.

1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

C. Patching: Partially fill excavated pavements with hot-mix asphalt base mix and, while still hot, compact. Cover asphalt base course with compacted, hot-mix surface layer finished flush with adjacent surfaces.

3.4 REPAIRS

A. Leveling Course: Install and compact leveling course consisting of hot-mix asphalt surface course to level sags and fill depressions deeper than 1 inch in existing pavements.
1. Install leveling wedges in compacted lifts not exceeding 3 inches thick.

B. Crack and Joint Filling: Remove existing joint filler material from cracks or joints to a depth of 1/4 inch.
1. Clean cracks and joints in existing hot-mix asphalt pavement.
2. Use emulsified-asphalt slurry to seal cracks and joints less than 1/4 inch wide. Fill flush with surface of existing pavement and remove excess.
3. Use hot-applied joint sealant to seal cracks and joints more than 1/4 inch wide. Fill flush with surface of existing pavement and remove excess.

3.5 SURFACE PREPARATION

A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.

B. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted- aggregate base before applying paving materials.
1. Mix herbicide with prime coat if formulated by manufacturer for that purpose.

C. Prime Coat: Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.15 to 0.50 gal./sq. y. Apply enough material to penetrate and seal but not flood surface. Allow prime coat to cure.
1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
2. Protect primed substrate from damage until ready to receive paving.

D. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd.
1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.6 PAVING GEOTEXTILE INSTALLATION

A. Apply tack coat uniformly to existing pavement surfaces at a rate of 0.20 to 0.30 gal./sq. yd.

B. Place paving geotextile promptly according to manufacturer's written instructions. Broom or roll geotextile smooth and free of wrinkles and folds. Overlap longitudinal joints 4 inches and transverse joints 6 inches.
1. Protect paving geotextile from traffic and other damage and place hot-mix asphalt paving overlay the same day.

3.7 HOT-MIX ASPHALT PLACING

A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.

1. Place hot-mix asphalt base course in number of lifts and thicknesses indicated.
2. Place hot-mix asphalt surface course in single lift.
3. Spread mix at minimum temperature of 250 deg F.
4. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes unless otherwise indicated.
5. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.

B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.

1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete a section of asphalt base course before placing asphalt surface course.

C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.8 JOINTS

A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.

1. Clean contact surfaces and apply tack coat to joints.
2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.
3. Offset transverse joints, in successive courses, a minimum of 24 inches.
4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Construct these joints using either "bulkhead" or "papered" method according to AI MS-22, for both "Ending a Lane" and "Resumption of Paving Operations."
5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
6. Compact asphalt at joints to a density within 2 percent of specified course density.

3.9 COMPACTION

A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.

1. Complete compaction before mix temperature cools to 185 deg F.

B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.

C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot- mix asphalt course has been uniformly compacted to the following density:

1. Average Density: 96 percent of reference laboratory density according to ASTM D 6927 or AASHTO T 245, but not less than 94 percent nor greater than 100 percent.
2. Average Density: 92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent nor greater than 96 percent.

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.

F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.

G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.10 INSTALLATION TOLERANCES

A. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:

1. Base Course: Plus or minus 1/2 inch.
2. Surface Course: Plus 1/4 inch, no minus.

B. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:

1. Base Course: 1/4 inch.
2. Surface Course: 1/8 inch.
3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.

3.11 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.

B. Allow paving to age for 30 days before starting pavement marking.

C. Sweep and clean surface to eliminate loose material and dust.

D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

3.12 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.

C. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.

D. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to ASTM D 979 or AASHTO T 168.

1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.
2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726.
    a. One core sample will be taken for every 1000 sq. yd. or less of installed pavement, with no fewer than 3 cores taken.
    b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.

E. Replace and compact hot-mix asphalt where core tests were taken.

F. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.13 DISPOSAL

A. Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose of them in an EPA-approved landfill.

1. Do not allow milled materials to accumulate on-site.

END OF SECTION 02745

SECTION 02751 - CEMENT CONCRETE PAVEMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Driveways.
2. Parking lots.
3. Curbs and gutters.
4. Walks.

B. Related Sections:
1. Division 2 Section "Pavement Joint Sealants" for joint sealants in expansion and contraction joints within concrete paving and in joints between concrete paving and asphalt paving or adjacent construction.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, and ground granulated blast-furnace slag.

1.4 SUBMITTALS

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

B. LEED Submittals:
1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
2. Design Mixtures for Credit ID 1: For each concrete mixture containing fly ash as a replacement for Portland cement or other Portland cement replacements. For each design mixture submitted, include an equivalent concrete mixture that does not contain Portland cement replacements, to determine amount of Portland cement replaced.

C. Shop Drawings: Indicate pavement markings, lane separations, and defined parking spaces. Indicate, with international symbol of accessibility, spaces allocated for people with disabilities.

D. Samples for Initial Selection: For each type of product, ingredient, or admixture requiring color selection.

E. Other Action Submittals:
1. Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

F. Qualification Data: For qualified ready-mix concrete manufacturer.

G. Material Certificates: For the following, from manufacturer:
1. Cementitious materials.
2. Steel reinforcement and reinforcement accessories.
3. Admixtures.
4. Curing compounds.
5. Applied finish materials.
6. Bonding agent or epoxy adhesive.
7. Joint fillers.

H. Material Test Reports: For each of the following:
1. Aggregates.

I. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

B. Testing Agency Qualifications: Qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

C. Concrete Testing Service: Engage a qualified testing agency to perform material evaluation tests and to design concrete mixtures.

D. ACI Publications: Comply with ACI 301 unless otherwise indicated.

1.6 PROJECT CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

B. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for oil-based materials 55 deg F for water-based materials, and not exceeding 95 deg F.

PART 2 - PRODUCTS

2.1 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.
1. Use flexible or uniformly curved forms for curves with a radius of 100 feet or less. Do not use notched and bent forms.

B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

2.2 STEEL REINFORCEMENT

A. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, fabricated from steel wire into flat sheets.

C. Deformed-Steel Welded Wire Reinforcement: ASTM A 497/A 497M, flat sheet.

D. Reinforcing Bars: ASTM A 615/A 615M, Grade 60; deformed.

E. Steel Bar Mats: ASTM A 184/A 184M; with ASTM A 615/A 615M, Grade 60, deformed bars; assembled with clips.

F. Deformed-Steel Wire: ASTM A 496/A 496M.

G. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 plain-steel bars. Cut bars true to length with ends square and free of burrs.

H. Tie Bars: ASTM A 615/A 615M, Grade 60, deformed.

I. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete specified, and as follows:

1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.

2.3 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of same type, brand, and source throughout Project:

1. Portland Cement: ASTM C 150, Portland cement Type I.
    a. Fly Ash: ASTM C 618, Class C or Class F.

B. Normal-Weight Aggregates: ASTM C 33, Class 1N, uniformly graded. Provide aggregates from a single source.

1. Maximum Coarse-Aggregate Size: 3/4 inch nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Water: Potable and complying with ASTM C 94/C 94M.

D. Air-Entraining Admixture: ASTM C 260.

E. Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.4 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

D. Evaporation Retarder: Waterborne, monomolecular, film forming, manufactured for application to fresh concrete.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.

2.5 RELATED MATERIALS

A. Joint Fillers: ASTM D 1751, asphalt-saturated cellulosic fiber in preformed strips.

B. Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, free of carbon black, nonfading, and resistant to lime and other alkalis.

1. Available Manufacturers:
   a. Bayer Corporation.
   b. ChemMasters.
   c. Conspec Marketing & Manufacturing Co., Inc.
   d. Davis Colors.
   e. Elementis Pigments, Inc.
   f. Hoover Color Corporation.
   g. Lambert Corporation.
   h. Scofield, L. M. Company.
   i. Solomon Colors.
2. Color: As selected by Vortex Building.

C. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

D. Epoxy Bonding Adhesive: ASTM C 881/C 881M, two-component epoxy resin capable of humid curing and bonding to damp surfaces; of class suitable for application temperature, of grade complying with requirements, and of the following types:

1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

2.6 DETECTABLE WARNING MATERIALS

A. Detectable Warning Stamp: Semirigid polyurethane mats with formed underside capable of imprinting detectable warning pattern on plastic concrete; perforated with a vent at each dome.
1. Size of Stamp: One piece matching detectable warning area shown on Drawings.

2.7 PAVEMENT MARKINGS

A. All pavement markings shall be Thermoplastic meeting the requirements of the Alabama Department of Transportation.

2.8 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.
1. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.
2. When automatic machine placement is used, determine design mixtures and obtain laboratory test results that meet or exceed requirements.

B. Proportion mixtures to provide normal-weight concrete with the following properties:
1. Compressive Strength (28 Days): 4000 psi.
2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.50.
3. Slump Limit: 5 inches, plus or minus 1 inch.

C. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.

D. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.
E. Cementitious Materials: Optional: 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.

2.9 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Furnish batch certificates for each batch discharged and used in the Work.
1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

B. Proof-roll prepared subbase surface below concrete paving and hardscape to identify soft pockets and areas of excess yielding.

1. Completely proof-roll subbase in one direction. Limit vehicle speed to 3 mph.
2. Proof-roll with a pneumatic-tired and loaded, 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
3. Correct subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch according to requirements in Division 2 Section "Earthwork."

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

3.2 PREPARATION

A. Remove loose material from compacted subbase surface before placing concrete.

3.3 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.4 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

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

3.5 JOINTS

A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.

1. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.

B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.

1. Continue steel reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of paving strips unless otherwise indicated.
2. Provide tie bars at sides of paving strips where indicated.

3. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.

C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.

1. Locate expansion joints at intervals of 50 feet unless otherwise indicated.
2. Extend joint fillers full width and depth of joint.
3. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
6. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 3/8-inch radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate grooving-tool marks on concrete surfaces.
    a. Tolerance: Ensure that grooved joints are within 3 inches either way from centers of dowels.
2. Doweled Contraction Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.

3.6 CONCRETE PLACEMENT

A. Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast-in.

B. Remove snow, ice, or frost from subbase surface and steel reinforcement before placing concrete. Do not place concrete on frozen surfaces.

C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

D. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.

E. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing.

F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

G. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.

1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement dowels and joint devices.

H. Screed paving surface with a straightedge and strike off.

I. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

J. Curbs and Gutters: Use design mixture for automatic machine placement. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing.

K. Slip-Form Paving: Use design mixture for automatic machine placement. Produce paving to required thickness, lines, grades, finish, and jointing.

1. Compact subbase and prepare subgrade of sufficient width to prevent displacement of slip- form paving machine during operations.

L. Cold-Weather Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:

1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
2. Do not use frozen materials or materials containing ice or snow.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.

M. Hot-Weather Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:

1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated in total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.7 FLOAT FINISHING

A. General: Do not add water to concrete surfaces during finishing operations.

B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power- driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.

1. Medium-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float- finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture.
2. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.

3.8 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Comply with ACI 306.1 for cold-weather protection.

C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete but before float finishing.

D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

E. Curing Methods: Cure concrete by moisture curing moisture-retaining-cover curing, curing compound, or a combination of these as follows:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
   a. Water.
   b. Continuous water-fog spray.
   c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover, placed in widest practicable width, with sides and ends lapped at least 12 inches and sealed by waterproof tape or adhesive.
3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas that have been subjected to heavy rainfall within three hours after initial application.

3.9 PAVING TOLERANCES

A. Comply with tolerances in ACI 117 and as follows:

1. Elevation: 3/4 inch.
2. Thickness: Plus 3/8 inch, minus 1/4 inch.
3. Surface: Gap below 10-foot-long, unleveled straightedge not to exceed 1/2 inch.
4. Alignment of Tie-Bar End Relative to Line Perpendicular to Paving Edge: 1/2 inch per 12 inches of tie bar.
5. Lateral Alignment and Spacing of Dowels: 1 inch.
6. Vertical Alignment of Dowels: 1/4 inch.
7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Paving Edge: 1/4 inch per 12 inches of dowel.
8. Joint Spacing: 3 inches.
9. Contraction Joint Depth: Plus 1/4 inch, no minus.
10. Joint Width: Plus 1/8 inch, no minus.

3.10 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.

B. Allow concrete paving to cure for a minimum of 28 days and be dry before starting pavement marking.

C. Sweep and clean surface to eliminate loose material and dust.

D. Apply paint with mechanical equipment to produce markings of dimensions indicated with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

1. Apply graphic symbols and lettering with paint-resistant, die-cut stencils, firmly secured to concrete surface. Mask an extended area beyond edges of each stencil to prevent paint application beyond stencil. Apply paint so that it cannot run beneath stencil.

3.11 WHEEL STOPS

A. Securely attach wheel stops to paving with not less than two galvanized-steel dowels located at one-quarter to one-third points. Install dowels in drilled holes in the paving and bond dowels to wheel stop. Recess head of dowel beneath top of wheel stop.

3.12 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd., 5000 sq. ft. or fraction thereof of each concrete mixture placed each day.
    a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when it is 80 deg F and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
6. Compressive-Strength Tests: ASTM C 39/C 39M; test one specimen at seven days and two specimens at 28 days.
    a. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.

C. Strength of each concrete mixture will be satisfactory if average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

D. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7-and 28-day tests.

E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.

F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.

G. Concrete paving will be considered defective if it does not pass tests and inspections.

H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

I. Prepare test and inspection reports.

3.13 REPAIRS AND PROTECTION

A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Architect.

B. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with Portland cement concrete bonded to paving with epoxy adhesive.

C. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 02751

SECTION 02764 - PAVEMENT JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Cold-applied joint sealants.
2. Hot-applied joint sealants.

B. Related Sections:

C. Division 2 Section "Asphalt Paving" for constructing joints between concrete and asphalt pavement.

D. Division 2 Section "Cement Concrete Pavement" for constructing joints in concrete pavement.

1.3 PRECONSTRUCTION TESTING

A. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, Samples of materials that will contact or affect joint sealants.
1. Testing will not be required if joint-sealant manufacturers submit joint-preparation data that are based on previous testing, not older than 24 months, of sealant products for compatibility with and adhesion to joint substrates and other materials matching those submitted.

1.4 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Product Certificates: For each type of joint sealant and accessory, from manufacturer.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for joint sealants.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Source Limitations: Obtain each type of joint sealant from single source from single manufacturer.

C. Product Testing: Test joint sealants using a qualified testing agency.
1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.

1.6 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:
1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer based on testing and field experience.

2.2 COLD-APPLIED JOINT SEALANTS

A. Single-Component, Nonsag, Silicone Joint Sealant for Concrete: ASTM D 5893, Type NS.

B. Single-Component, Self-Leveling, Silicone Joint Sealant for Concrete: ASTM D 5893, Type SL.

C. Multicomponent, Pourable, Traffic-Grade, Urethane Joint Sealant for Concrete: ASTM C 920, Type M, Grade P, Class 25, for Use T.

2.3 HOT-APPLIED JOINT SEALANTS

A. Hot-Applied, Single-Component Joint Sealant for Concrete: ASTM D 3406.

B. Hot-Applied, Single-Component Joint Sealant for Concrete and Asphalt: ASTM D 6690, Types I, II, and III.

2.4 JOINT-SEALANT BACKER MATERIALS

A. General: Provide joint-sealant backer materials that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint-sealant manufacturer based on field experience and laboratory testing.

B. Round Backer Rods for Cold-and Hot-Applied Joint Sealants: ASTM D 5249, Type 1, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

C. Backer Strips for Cold-and Hot-Applied Joint Sealants: ASTM D 5249; Type 2; of thickness and width required to control joint-sealant depth, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.

2.5 PRIMERS

A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant- substrate tests and field tests.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

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

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.

B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated unless more stringent requirements apply.

B. Joint-Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install joint-sealant backings of kind indicated to support joint sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of joint-sealant backings.
2. Do not stretch, twist, puncture, or tear joint-sealant backings.
3. Remove absorbent joint-sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install joint sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place joint sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of Nonsag Joint Sealants: Immediately after joint-sealant application and before skinning or curing begins, tool sealants according to the following requirements to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint:

1. Remove excess joint sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.

F. Provide joint configuration to comply with joint-sealant manufacturer's written instructions unless otherwise indicated.

3.4 CLEANING

A. Clean off excess joint sealant or sealant smears adjacent to joints as the Work progresses, by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

A. Protect joint sealants, during and after curing period, from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations in repaired areas are indistinguishable from the original work.

3.6 PAVEMENT-JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Joints within cement concrete pavement.
   1. Joint Location:
      a. Expansion and isolation joints in cast-in-place concrete pavement.
      b. Contraction joints in cast-in-place concrete slabs.
      c. Other joints as indicated.
   2. Silicone Joint Sealant for Concrete: Single component, nonsag.
   3. Urethane Joint Sealant for Concrete: Multicomponent, pourable, traffic-grade.
   4. Hot-Applied Joint Sealant for Concrete: Single component.

B. Joint-Sealant Application: Joints between cement concrete and asphalt pavement.
   1. Joint Location:
      a. Joints between concrete and asphalt pavement.
      b. Joints between concrete curbs and asphalt pavement.
      c. Other joints as indicated.
   2. Hot-Applied Joint Sealant for Concrete and Asphalt: Single component.

END OF SECTION 02764

SECTION 02780 - CLAY UNIT PAVERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section consists of furnishing and installing clay paver units, sand setting bed and joint sand in walkways and pedestrian plaza areas.

B. Related work specified elsewhere:
1. Division 2 Earthwork section.
2. Division 2 Cement Concrete Pavement section.
3. Division 3 Cast-in-Place Concrete section.

1.2 QUALITY ASSURANCE

A. Standards:
1. ASTM C902 Standard Specification for Pedestrian And Light Traffic Paving Brick
2. ASTM C1272 Standard Specification for Heavy Vehicular Paving Brick
3. ASTM C136 Method for Sieve Analysis for Fine and Coarse Aggregate.
4. ASTM C67 Method of Sampling and Testing Brick and Structural Clay Tile.
5. ASTM C33 Specification for Concrete Aggregates.

B. Qualified Installer: Installation shall be by an installer with at least two years' experience and who has installed at least 200,000 square feet of sand-set pavers in commercial projects.

1.3 SUBMITTALS

A. Submit shop or product drawings and product data.

B. Submit sieve analysis for grading of bedding and joint sand.

C. Submit polymeric joint sand manufacturer's product data.

D. Submit test results for compliance of paving unit requirements to ASTM C 902 or ASTM C1272 from an independent testing laboratory.

E. Submit installer qualifications: provide satisfactory evidence that the installer complies with the qualifications set out in Section 1.2.

F. Schedule & Work Plan: submit a detailed schedule and work plan

1.4 MOCK-UPS

A. Prepare a 10 linear foot mockup of each type of banding shown in the Drawings, inset in an adequate concrete area matching details shown in the Drawings. This mockup will be used to determine surcharge of the sand layer, joint sizes, lines, laying patterns, colors, and texture of the job. This mockup shall become the standard from which the work will be judged.

B. When directed by the Landscape Architect, demolish and removed mockup from the site.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver brick pavers to the site in steel banded, plastic banded, or plastic wrapped cubes or on pallets capable of transfer by fork lift or clamp lift. Unload pavers at job site in such a manner that no damage occurs to the product.

B. Sand shall be covered with waterproof covering to prevent exposure to rainfall or removal by wind. The covering shall be secured in place.

1.6 JOB CONDITIONS

A. Do not install sand or pavers during heavy rain or snowfall.

B. Do not install sand that is frozen or contains ice.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Manufactured Units:
1. Brick pavers shall be A Grade pavers manufactured/supplied by a member of the Brick Institute of America (BIA). The BIA manufacturer/supplier shall be:
a. Name: PINE HALL BRICK
1) Address: P. O. Box 11044 2701 Shorefair Drive Winston-Salem, NC 27116-1044
2)Phone:(800) 334-8689
b. Approved substitute.
2. Product name/shape, overall dimensions, and thickness of the paver(s) used shall be:
a. Standard Pavers: English Edge Full Range, 4" x 8" (including spacer lugs), 2 1/4” thick.
b. Truncated Dome Pavers: English Edge Full Range, 4” x 8” (including spacer lugs), 2 1/4” thick.
c. Heavy Vehicular pavers: English Edge Full Range, 4" x 8" (including spacer lugs), 2 1/4" thick.
3. Pavers shall meet the following requirements:
a. ASTM C902, Specification for Pedestrian and Light Traffic Paving Brick; or
b. ASTM C1272, Specification for Heavy Vehicular Paving Brick, and shall conform to the PX standard.
c. Minimum average compressive strength of 10,000 psi.
d. The average cold water absorption shall not be greater than 6% with no individual unit testing greater than 7%. Absorption test results may not be achieved through the use of sealers or other products applied to the clay paver.
e. Resistance of 50 freeze/thaw cycles, when tested in accordance with ASTM C67. In addition, the clay paver must pass CSA-A231.2 freeze thaw test in saline solution without the use of sealers or other products applied to the paver. A test report must be submitted by the manufacturer.
f. Dimensional tolerances should meet the PX standard. The dimensional tolerances around the mean values for length, width, and depth shall be 1/16".
g. The pavers shall be solid units without core holes or other perforations.

h. The contractor shall ensure that the manufacturer conducts a test sampling of 24 pavers of every 50,000 pavers manufactured to determine the pavers compliance with dimensional and water absorption characteristics. The 24-paver sample shall be representative of the color mix in the typical finished package and chosen on a consistent basis from one kiln car.

B. Bedding and Joint Sand:

1. Bedding and joint sand shall be clean, non-plastic, free from deleterious or foreign matter. The sand shall be natural or manufactured from crushed rock. Grading of samples shall be done according to ASTM C136. The particles shall be sharp and conform to the grading requirements of ASTM C33 as shown below:

Sieve Size	Percent Passing
3/8 in	100
No. 4	95 to 100
No. 8	80 to 100
No. 16	50 to 85
No. 30	25 to 60
No. 50	10 to 30
No. 100	2 to 10

2. Edge Restraints:

a. Construct edge conditions as shown in the Drawings.

3. Joint Sand Stabilizers:

a. Apply polymeric joint sand stabilizer in all joint areas. Apply in strict accordance with manufacturer's instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that base is dry, uniform, even and ready to support sand, pavers and imposed loads.

B. Verify gradients and elevations of base are correct.

C. Verify location, type, installation and elevations of edge restraints around the perimeter area to be paved.

D. Beginning of installation shall signify acceptance of base conditions.

3.2 PAVER INSTALLATION

A. Install edge restraints as indicated in the Drawings, or construct bases as shown in the Drawings, before placing unit pavers.

B. Spread the sand evenly over the base course and screed to 1½ inches thickness. The screeded sand should not be disturbed. Sufficient sand shall be placed to ensure that no delay occurs in laying pavers. The screeded bedding sand shall not be subjected to any traffic by either mechanical or pedestrian use.

C. Ensure that pavers are free of foreign material before installation. The installer shall take the pavers from the pallet by row consisting of 18 pavers. Each row shall be installed together to ensure proper color mix.

D. Lay the pavers in the pattern(s) as shown on the Drawings. Full pavers are to be laid first. The pavers should be laid hand tight. Maintain straight pattern lines and adjust as necessary.

E. Joints between the pavers shall be between 1/16 inch and 1/8 inch maximum (2 to 3 mm) wide.

F. Cut pavers shall be installed only along the middle sections of bands, not at ends or corners, nor within the distance from ends or corners described in the Drawings. Cut pavers shall be cut using a masonry saw, and cut in such a manner that no segment is smaller than half a full paver in either width or length.

G. Use a low amplitude, high frequency plate vibrator capable of 3,000 to 5,000 lbs. centrifugal compaction force to vibrate the pavers into the bedding sand. Vibrate the pavers, sweeping dry sand into the joints and vibrating until they are full. Make at least three passes with the vibrator. Do not vibrate within three feet of the unrestrained edges of the paving units.

H. All work to within three feet of the laying face must be left fully compacted with sand-filled joints at the completion of each day.

1. Sweep off excess sand when the job is complete. Contractor shall return to the site one month after installation is complete to inspect sand in joints. Contractor is responsible for adding additional sand to fill joints where necessary.
2. The final surface elevations shall not deviate more than 1/4 inch under a 10-foot long straightedge.
3. The surface elevation of pavers shall be no more than 1/4” above adjacent concrete paving.

3.3 JOINT SAND STABILIZER APPLICATION

A. The surface shall be made clean and free from oil, dust from cutting and any loose material prior to the application of a polymeric joint sand stabilizer. The surface and joint sand shall be dry for its full depth prior to commencing work.

B. The treated area shall be protected from rain or moisture and shall not be trafficked for 24 hours after the completion of the stabilizer application.

C. Apply polymeric joint stabilizer in strict accordance with Manufacturer's instructions.

3.4 FIELD QUALITY CONTROL

A. After removal of excess sand, check final elevations for conformance to the Drawings and Specifications.

3.5 PROTECTION AND CLEANUP

A. Protection:
   1. Protect work from damage, discoloration and theft.
   2. All vehicles and equipment operating on the completed pavers before and after application of the joint sand stabilizer shall be maintained in a clean condition, so that oil, tar, rubber or other matter is not deposited on the surface of the pavers or adjacent paving and features.
   3. Cleanup:
      a. All materials generated by construction work in this section shall be removed at the end of each section of the work and the site shall be left in a clean and safe condition.
      b. After completion of any repair work, clean all exposed surfaces with clean water and stiff brushes until all stains and dirt are removed. Use cleaning solutions only that are recommended by the paver and stabilizer manufacturers and do not use wire brushes.

3.6 REPAIRS AND MAINTENANCE

A. Repairs:
   1. Repair or replace any damaged work to the original specified condition prior to handover.
   2. Where lateral displacement of the pavers has occurred in areas where cut pavers were used, the cut pavers shall be replaced with new pavers of the correct size to comply with the specified joint widths and the surface shall be re-established.
   3. Maintenance: The installer shall return to the site at the Owner's request over a period of one year from Substantial Completion to rectify any problems in the work caused by its failure adequately to align the pavers, compact the bedding sand or fill the joints.

END OF SECTION 02780

SECTION 02820 - CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Chain-link fences.
2. Gates: swing.

B. Related Sections:
1. Section 03300 "Cast-in-Place Concrete" for cast-in-place concrete post footings.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for chain-link fences and gates.
1. Fence and gate posts, rails, and fittings.
2. Chain-link fabric, reinforcements, and attachments.
3. Gates and hardware.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work. Show accessories, hardware, gate operation, and operational clearances.

C. Samples for Initial Selection: For components with factory-applied color finishes.

D. Samples for Verification: Prepared on Samples of size indicated below:
1. Polymer-Coated Components: In 6-inch lengths for components and on full-sized units for accessories.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of chain-link fence, and gate, from manufacturer.

B. Product Test Reports: For framing strength according to ASTM F 1043.

C. Field quality-control reports.

D. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For the following to include in emergency, operation, and maintenance manuals:
1. Polymer finishes.
2. Gate hardware.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to property survey and existing structures. Verify existing fence location and height. New fence shall match existing top rail elevation. Verify dimensions by field measurements.

PART 2 - PRODUCTS

2.1 Fencing products of fabric and framework specified by descriptions are comparable among many manufacturers, so a manufacturer's name is usually not required.

2.2 CHAIN-LINK FENCE FABRIC

A. General: Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle or twist. Comply with CLFMI Product Manual and with requirements indicated below:

B. ASTM standards and CLFMI Product Manual limit height of fence fabric to 12 feet (3.66 m).
1. Fabric Height: As indicated on Drawings.
2. Steel Wire Fabric: Wire with a diameter of 0.148 inch.
   a. Mesh Size: 2 inches.
   b. Zinc-Coated Fabric: ASTM A 392, Type II, Class 1, 1.2 oz./sq. ft. with zinc coating applied after weaving.
   c. Polymer-Coated Fabric: ASTM F 668, Class 2b over zinc-coated steel wire.
      1) Color: Black, complying with ASTM F 934.
   d. Coat selvage ends of fabric that is metallic coated before the weaving process with manufacturer's standard clear protective coating.
3. Selvage: Knuckled at both selvages.

2.3 FENCE FRAMING

A. Posts and Rails: Comply with ASTM F 1043 for framing, including rails, braces, and line; terminal; and corner posts. Provide members with minimum dimensions and wall thickness according to ASTM F 1043 or ASTM F 1083 based on the following:
1. Fence Height: As indicated on Drawings.
2. Line Post: Match existing court fencing.
3. End, Corner and Pull Post: Match existing court fencing.
4. Horizontal Framework Members: Intermediate and top rails complying with ASTM F 1043.
   a. Top Rail: Match existing court fencing.

5. Brace Rails: Comply with ASTM F 1043.
6. Metallic Coating for Steel Framing:
   a. Type A, consisting of not less than minimum 2.0-oz./sq. ft. average zinc coating per ASTM A 123/A 123M or 4.0-oz./sq. ft. zinc coating per ASTM A 653/A 653M.
7. Polymer coating over metallic coating.
   a. Color: Match chain-link fabric, complying with ASTM F 934.

2.4 TENSION WIRE

A. Polymer-Coated Steel Wire: 0.177-inch- diameter, tension wire complying with ASTM F 1664, Class 2b over zinc-coated steel wire.
   1. Color: Match chain-link fabric, complying with ASTM F 934.

2.5 SWING GATES

A. General: Comply with ASTM F 900 for gate posts and single and double swing gate types.
   1. Gate Leaf Width: As indicated.
   2. Gate Fabric Height: As indicated.

B. Pipe and Tubing:
   1. Zinc-Coated Steel: Comply with ASTM F 1043 and ASTM F 1083; protective coating and finish to match fence framing.
   2. See ASTM F 900 if size of members is critical and revise both subparagraphs below.
   3. Gate Posts: Round tubular steel.
   4. Gate Frames and Bracing: Round tubular steel.

C. Frame Corner Construction: Assembled with corner fittings.

D. Hardware:
   1. Hinges: 360-degree inward and outward swing.
   2. Latches permitting operation from both sides of gate with provision for padlocking accessible from both sides of gate.

2.6 FITTINGS

A. General: Comply with ASTM F 626.

B. Post Caps: Provide for each post.
   1. Provide line post caps with loop to receive tension wire or top rail.

C. Rail and Brace Ends: For each gate, corner, pull, and end post.

D. Rail Fittings: Provide the following:
   1. Top Rail Sleeves: Pressed-steel or round-steel tubing not less than 6 inches long.
   2. Rail Clamps: Line and corner boulevard clamps for connecting intermediate rails in the fence line-to-line posts.

E. Tension and Brace Bands: Pressed steel.

F. Tension Bars: Steel, length not less than 2 inches shorter than full height of chain-link fabric. Provide one bar for each gate and end post, and two for each corner and pull post, unless fabric is integrally woven into post.

G. According to CLFMI, truss rod may be eliminated from compression brace in any line of steel fence with round or C-section line post that has a continuous center rail. Diagonal truss rod assemblies are positioned at a 45- to 50-degree angle running from brace rail, usually at midpoint of line post to bottom of terminal post.

H. Truss Rod Assemblies: Steel, hot-dip galvanized after threading rod and turnbuckle or other means of adjustment.

I. Tie Wires, Clips, and Fasteners: According to ASTM F 626.
   1. Standard Round Wire Ties: For attaching chain-link fabric to posts, rails, and frames, complying with the following:
      a. Hot-Dip Galvanized Steel: 0.148-inch- diameter wire; galvanized coating thickness matching coating thickness of chain-link fence fabric.

J. Finish:
   1. Metallic Coating for Pressed Steel or Cast Iron: Not less than 1.2 oz. /sq. ft. zinc.
   2. ASTM F 626 specifies that the polymer coating match the color coating of the fence chain-link fabric.
      a. Polymer coating over metallic coating.

2.7 GROUT AND ANCHORING CEMENT

A. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout, recommended in writing by manufacturer, for exterior applications.

B. Erosion-Resistant Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with potable water at Project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended in writing by manufacturer, for exterior applications.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, and other conditions affecting performance of the Work.
   1. Do not begin installation before final grading is completed unless otherwise permitted by Architect.

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

3.2 PREPARATION

A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

3.3 INSTALLATION, GENERAL

A. Install chain-link fencing to comply with ASTM F 567 and more stringent requirements indicated.
   1. Install fencing on established boundary lines inside property line.

3.4 CHAIN-LINK FENCE INSTALLATION

A. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.

B. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.
   1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
   2. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
      a. Concealed Concrete: Top 3 inches below grade to allow covering with surface material.
      b. Posts Set into Voids in Concrete: Form or core drill holes not less than 5 inches deep and 3/4 inch larger than OD of post. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions, and finished sloped to drain water away from post.

C. Terminal Posts: Locate terminal end, corner, and gate posts per ASTM F 567 and terminal pull posts at changes in horizontal or vertical alignment of 30 degrees or more.

D. Line Posts: Space line posts uniformly at 10 feet o.c.

E. Post Bracing and Intermediate Rails: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Diagonally brace terminal posts to adjacent line posts with truss rods and turnbuckles. Install braces at end and gate posts and at both sides of corner and pull posts.
   1. Locate horizontal braces at midheight of fabric 60 inches or higher, on fences with top rail and at two-third fabric height on fences without top rail. Install so posts are plumb when diagonal rod is under proper tension.

F. Tension Wire: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Pull wire taut, without sags. Fasten fabric to tension wire with 0.120-inch- diameter hog rings of same material and finish as fabric wire, spaced a maximum of 24 inches o.c. Install tension wire in locations indicated before stretching fabric. Provide horizontal tension wire at the following locations:
   1. Extended along bottom of fence fabric. Install bottom tension wire within 6 inches of bottom of fabric and tie to each post with not less than same diameter and type of wire.

G. Top Rail: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Run rail continuously through line post caps, bending to radius for curved runs and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended in writing by fencing manufacturer.

H. Intermediate and Bottom Rails: Install and secure to posts with fittings.

I. Chain-Link Fabric: Apply fabric to inside of enclosing framework. Leave 1 inch between finish grade or surface and bottom selvage unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.

J. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts with tension bands spaced not more than 15 inches o.c.

K. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at one end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric per ASTM F 626. Bend ends of wire to minimize hazard to individuals and clothing.

1. Maximum Spacing: Tie fabric to line posts at 12 inches o.c. and to braces at 24 inches o.c.

L. Fasteners: Install nuts for tension bands and carriage bolts on the side of the fence opposite the fabric side.

3.5 GATE INSTALLATION

A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper- resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

3.6 ADJUSTING

A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Lubricate hardware and other moving parts.

END OF SECTION 02820

SECTION 03300 - CAST-IN-PLACE CONCRETE

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:

1. Footings.
2. Foundation walls.
3. Slabs-on-grade.
4. Suspended slabs.

B. Related Sections include the following:

1. Division 2 Section "Earthwork" for drainage fill under slabs-on-grade.
2. Division 2 Section "Cement Concrete Pavement" for concrete pavement and walks.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast- furnace slag, and silica fume; subject to compliance with requirements.

1.4 SUBMITTALS

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

B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1. Indicate amounts of mixing water to be withheld for later addition at Project site.

C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

D. Samples: For waterstops, vapor retarder.

E. Welding certificates.

F. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Form materials and form-release agents.
4. Steel reinforcement and accessories.

5. Waterstops.
6. Curing compounds.
7. Floor and slab treatments.
8. Bonding agents.
9. Adhesives.
10. Vapor retarders.
11. Semirigid joint filler.
12. Joint-filler strips.
13. Repair materials.

G. Floor surface flatness and levelness measurements to determine compliance with specified tolerances.

H. Field quality-control test and inspection reports.

I. LEED Submittals:
1. Product Data for Credit MR 4.1 and Credit MR 4.2: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
a. Include statement indicating costs for each product having recycled content.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Testing Agency Qualifications: An independent agency, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.

D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.

E. Welding: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code--Reinforcing Steel."

F. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
1. ACI 301, "Specification for Structural Concrete."
2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

G. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

H. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
   a. Contractor's superintendent.
   b. Independent testing agency responsible for concrete design mixtures.
   c. Ready-mix concrete manufacturer.
   d. Concrete subcontractor.
2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semirigid joint fillers, forms and form removal limitations, vapor-retarder installation, steel reinforcement installation, floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

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

2.2 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

1. Plywood, metal, or other approved panel materials.
2. Exterior-grade plywood panels, suitable for concrete forms

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

D. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.

E. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

F. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
2. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.

2.3 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

B. Plain-Steel Wire: ASTM A 82, as drawn, galvanized.

C. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets.

2.4 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), plain-steel bars, cut bars true to length with ends square and free of burrs.

B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2.5 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:

1. Portland Cement: ASTM C 150, Type I**:**
   a. Fly Ash: ASTM C 618, Class C, F.

B. Normal-Weight Aggregates: ASTM C 33, coarse aggregate or better, graded. Provide aggregates from a single source.

1. Maximum Coarse-Aggregate Size: 3/4 inch nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Water: ASTM C 94/C 94M and potable.

2.6 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.

2.7 WATERSTOPS

A. Flexible Rubber Waterstops: CE CRD-C 513, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.

1. Manufacturers:
   a. Greenstreak.
   b. Progress Unlimited, Inc.
   c. Williams Products, Inc.

B. Flexible PVC Waterstops: CE CRD-C 572, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.

1. Manufacturers:
   a. Bometals, Inc.
   b. Greenstreak.
   c. Meadows, W. R., Inc.
   d. Murphy, Paul Plastics Co.
   e. Progress Unlimited, Inc.
   f. Tamms Industries, Inc.
   g. Vinylex Corp.

C. Self-Expanding Rubber Strip Waterstops: Manufactured rectangular or trapezoidal strip, bentonite-free hydrophilic polymer modified chloroprene rubber, for adhesive bonding to concrete, 3/8 by 3/4 inch.

1. Products:
   a. Deneef Construction Chemicals; Swellseal.
   b. Greenstreak; Hydrotite.
   c. Mitsubishi International Corporation; Adeka Ultra Seal.
   d. Progress Unlimited, Inc.; Superstop.

2.8 VAPOR RETARDERS

A. Plastic Vapor Retarder: ASTM E 1745-09, Class A with a permeance of less than 0.01 perms before and after mandatory conditioning tests contained in ASTM E 1745-09, Section 7. Not less than 15 mils thick.

1. Fortifiber Corporation; Moistop Ultra A.
2. Raven Industries Inc.; Vapor Block 15.
3. Reef Industries, Inc.; Griffolyn Type-65G.

B. Plastic Vapor Retarder: ASTM E 1745, Class C, or polyethylene sheet, ASTM D 4397, not less than 10 mils (0.25 mm) thick. Include manufacturer's recommended adhesive or pressure-sensitive joint tape.

1. Available
   a. Fortifiber Corporation
   b. Moistop Plus
   c. Raven Industries Inc.
   d. Dura Skrim 6. Reef Industries, Inc.
   a. Griffolyn Type-65
   b. Stego Industries, LLC
   c. Stego Wrap, 10 mils.

C. Bituminous Vapor Retarder: 110-mil- thick, semiflexible, 7-ply sheet membrane consisting of reinforced core and carrier sheet with fortified asphalt layers, protective weathercoating, and removable plastic release liner. Furnish manufacturer's accessories including bonding asphalt, pointing mastics, and self-adhering joint tape.

1. Product: Meadows, W. R., Inc.; Premoulded Membrane Vapor Seal.
2. Water-Vapor Permeance: 0.00 grains/h x sq. ft. x inches Hg ; ASTM E 154.
3. Tensile Strength: 140 lbf/in.; ASTM E 154.
4. Puncture Resistance: 90 lbf ; ASTM E 154.

D. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448, Size 57, with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

E. Fine-Graded Granular Material: Clean mixture of crushed stone, crushed gravel, and manufactured or natural sand; ASTM D 448, Size 10, with 100 percent passing a 3/8-inch sieve, 10 to 30 percent passing a No. 100 sieve, and at least 5 percent passing No. 200 sieve; complying with deleterious substance limits of ASTM C 33 for fine aggregates.

1.7 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

1. Products:
   a. Axim Concrete Technologies; Cimfilm.
   b. Burke by Edoco; BurkeFilm.
   c. ChemMasters; Spray-Film.
   d. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Aquafilm.
   e. Dayton Superior Corporation; Sure Film.
   f. Euclid Chemical Company; Eucobar.
   g. Kaufman Products, Inc.; Vapor Aid.
   h. Lambert Corporation; Lambco Skin.
   i. L&M Construction Chemicals, Inc.; E-Con.
   j. MBT Protection and Repair, Div. of ChemRex; Confilm.
   k. Meadows, W. R., Inc.; Sealtight Evapre.
   l. Metalcrete Industries; Waterhold.
   m. Nox-Crete Products Group, Kinsman Corporation; Monofilm.
   n. Sika Corporation, Inc.; SikaFilm.
   o. Symons Corporation, a Dayton Superior Company; Finishing Aid.

p. Unitex; Pro-Film.
q. US Mix Products Company; US Spec Monofilm ER.
r. Vexcon Chemicals, Inc.; Certi-Vex EnvioAssist.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, 18 to 25 percent solids, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.

1. Products:
   a. Burke by Edoco; Spartan Cote WB II 20 Percent.
   b. ChemMasters; Safe-Cure Clear.
   c. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; High Seal.
   d. Dayton Superior Corporation; Safe Cure and Seal (J-19).
   e. Euclid Chemical Company (The); Diamond Clear VOX.
   f. Kaufman Products, Inc.; SureCure Emulsion.
   g. Lambert Corporation; Glazecote Sealer-20.
   h. L&M Construction Chemicals, Inc.; Dress & Seal WB.
   i. MBT Protection and Repair, Div. of ChemRex; MasterKure-N-Seal VOC.
   j. Meadows, W. R., Inc.; Vocomp-20.
   k. Metalcrete Industries; Metcure 0800.
   l. Nox-Crete Products Group, Kinsman Corporation; Cure & Seal 200E.
   m. Sonneborn, Div. of ChemRex; Kure-N-Seal.
   n. Symons Corporation, a Dayton Superior Company; Cure & Seal 18 Percent E.
   o. Tamms Industries, Inc.; Clearseal WB STD.
   p. Unitex; Hydro Seal 18.
   q. US Mix Products Company; US Spec Radiance UV-25
   r. Vexcon Chemicals, Inc.; Starseal 0800.

F. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

1. Products:
   a. Burke by Edoco; Cureseal 1315.
   b. ChemMasters; Spray-Cure & Seal Plus.
   c. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Sealcure 1315.
   d. Dayton Superior Corporation; Day-Chem Cure and Seal (J-22UV).
   e. Euclid Chemical Company ; Super Diamond Clear.
   f. Kaufman Products, Inc.; Sure Cure 25.
   g. Lambert Corporation; UV Super Seal.
   h. L&M Construction Chemicals, Inc.; Lumiseal Plus.
   i. Meadows, W. R., Inc.; CS-309/30.
   j. Metalcrete Industries; Seal N Kure 0.
   k. Sonneborn, Div. of ChemRex; Kure-N-Seal 5.
   l. Tamms Industries, Inc.; LusterSeal 300.

m. Unitex; Solvent Seal 1315.
n. US Mix Products Company; US Spec CS-25
o. Vexcon Chemicals, Inc.; Certi-Vex AC 1315

G. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

1. Products:
   a. Burke by Edoco; Cureseal 1315 WB.
   b. ChemMasters; Polyseal WB.
   c. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Sealcure 1315 WB.
   d. Euclid Chemical Company; Super Diamond Clear VOX.
   e. Kaufman Products, Inc.; Sure Cure 25 Emulsion.
   f. Lambert Corporation; UV Safe Seal.
   g. L&M Construction Chemicals, Inc.; Lumiseal WB Plus.
   h. Meadows, W. R., Inc.; Vocomp-30.
   i. Metalcrete Industries; Metcure 30.
   j. Symons Corporation, a Dayton Superior Company; Cure & Seal 31 Percent E.
   k. Tamms Industries, Inc.; LusterSeal WB 300.
   l. Unitex; Hydro Seal 25.
   m. US Mix Products Company; US Spec Radiance UV-25.
   n. Vexcon Chemicals, Inc.; Vexcon Starseal 1315.

1.8 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 per ASTM D 2240.

C. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:

1. Types I and II, non-load bearing IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

E. Reglets: Fabricate reglets of not less than 0.0217-inch- thick, galvanized steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

F. Dovetail Anchor Slots: Hot-dip galvanized steel sheet, not less than 0.0336 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

1.9 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 4100 psi (29 MPa) at 28 days when tested according to ASTM C 109/C 109M.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5000 psi (34.5 MPa) at 28 days when tested according to ASTM C 109/C 109M.

1.10 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.

1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash: 25 percent.
2. Combined Fly Ash or Pozzolans, Ground Granulated Blast-Furnace Slag, and Silica Fume: 50 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.

C. Limit water-soluble, chloride-ion content in hardened concrete to 0.06 0.15 0.30 1.00 percent by weight of cement.

D. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.

1.11 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

1.12 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.

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

PART 3 - EXECUTION

3.1 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Construct forms tight enough to prevent loss of concrete mortar.

D. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.

1. Install keyways, reglets, recesses, and the like, for easy removal.
2. Do not use rust-stained steel form-facing material.

E. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

F. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

G. Chamfer exterior corners and edges of permanently exposed concrete.

H. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

I. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

J. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

K. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
3. Install dovetail anchor slots in concrete structures as indicated.

3.3 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete, if concrete is hard enough to not be damaged by form- removal operations and curing and protection operations are maintained.

1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 VAPOR RETARDERS

A. Plastic Vapor Retarders: Place, protect, and repair vapor retarders according to ASTM E 1643 and manufacturer's written instructions.

1. Lap joints 6 inches and seal with manufacturer's recommended tape.

B. Bituminous Vapor Retarders: Place, protect, and repair vapor retarders according to manufacturer's written instructions.

C. Granular Course: granular fill fine-graded granular material, moisten, and compact with mechanical equipment to elevation tolerances of plus 0 inch or minus 3/4 inch.

1. Place and compact a 1/2-inch thick layer of fine-graded granular material over granular fill.

3.5 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

1. Weld reinforcing bars according to AWS D1.4, where indicated.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.6 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches, into concrete.
3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
5. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
7. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one- fourth of concrete thickness as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.

2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Division 7 Section "Joint Sealants," are indicated.
3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.7 WATERSTOPS

A. Flexible Waterstops: Install in construction joints and at other joints indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of the Work. Field fabricate joints in waterstops according to manufacturer's written instructions.

B. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, adhesive bonding, mechanically fastening, and firmly pressing into place. Install in longest lengths practicable.

3.8 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.

C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.

2. Maintain reinforcement in position on chairs during concrete placement.
3. Screed slab surfaces with a straightedge and strike off to correct elevations.
4. Slope surfaces uniformly to drains where required.
5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

G. Hot-Weather Placement: Comply with ACI 301 and as follows:
1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.9 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
1. Apply to concrete surfaces exposed to public view.

C. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete all vertical and overhead locations.
1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.

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

3.10 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in 1 direction.

1. Apply scratch finish to surfaces to receive concrete floor toppings.

C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces indicated to receive trowel finish.

D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film- finish coating system.
2. Finish surfaces to the following tolerances, according to ASTM E 1155, for a randomly trafficked floor surface:
    a. Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17; for slabs-on- grade.
    b. Specified overall values of flatness, F(F) 30; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 15; for suspended slabs.
    c. Provide superflat concrete values at access flooring locations, see Drawings.
3. Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-foot-long straightedge resting on 2 high spots and placed anywhere on the surface does not exceed 1/8 inch.

E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.

1. Comply with flatness and levelness tolerances for trowel finished floor surfaces.

F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

G. Slip-Resistive Finish: Before final floating, apply slip-resistive aggregate finish where indicated and to concrete stair treads, platforms, and ramps. Apply according to manufacturer's written instructions.

H. Force Platforms on Ground Floor Bio Mechanics and Motion Study Rooms: The area over the force plaforms in these areas shall be flat and level to better than .05 mm (.002”).

3.11 MISCELLANEOUS CONCRETE ITEMS

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

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

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.

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

3.12 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot- weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
   1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
      a. Water.
      b. Continuous water-fog spray.
      c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
   a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
   b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
   c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project..
3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
   a. After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.
4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.13 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
   1. Defer joint filling until concrete has aged at least one six month(s). Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.14 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension in solid concrete, but not less than 1 inch in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush- coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
2. After concrete has cured at least 14 days, correct high areas by grinding.
3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

3.15 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Testing and Inspecting: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

C. Inspections:
1. Steel reinforcement placement.
2. Headed bolts and studs.
3. Verification of use of required design mixture.
4. Concrete placement, including conveying and depositing.
5. Curing procedures and maintenance of curing temperature.

D. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.
2. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. (76 cu. m) or fraction thereof of each concrete mixture placed each day.
    a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
3. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
4. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
5. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when 80 deg F (27 deg C) and above, and one test for each composite sample.
6. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
7. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
    a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
    b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
8. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
9. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).

10. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
11. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
12. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
13. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
14. Correct deficiencies in the Work that test reports and inspections indicate dos not comply with the Contract Documents.

E. Measure floor and slab flatness and levelness according to ASTM E 1155 (ASTM E 1155M) within 48 hours of finishing.

END OF SECTION 03300

SECTION 03451 - ARCHITECTURAL PRECAST CONCRETE

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Architectural precast concrete trim and decorative elements. All precast concrete trim shall be "wet pour" type. No "dry tamp" precast concrete will be allowed on this project.

B. Supports, anchors, and attachments.

1.2 RELATED REQUIREMENTS

A. Section 03300 - Cast-in-Place Concrete: Admixtures.

B. Section 04810 - Unit Masonry Asseblies: Substrate and anchors.

C. Section 07620 - Sheet Metal Flashing and Trim: Reglets recessed in units.

D. Section 07900 - Joint Sealers: Perimeter joints with sealant and backing.

1.3 REFERENCE STANDARDS

A. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; American Concrete Institute International; 2008.

B. ASTM A 36/A 36M - Standard Specification for Carbon Structural Steel; 2008.

C. ASTM A 123/A 123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2009.

D. ASTM A 153/A 153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

E. ASTM A 307 - Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength; 2007b.

F. ASTM A 563 - Standard Specification for Carbon and Alloy Steel Nuts; 2007a.

G. ASTM A 563M - Standard Specification for Carbon and Alloy Steel Nuts [Metric]; 2007.

H. ASTM A 615/A 615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement; 2009b.

I. ASTM C 33 - Standard Specification for Concrete Aggregates; 2008.

J. ASTM C 150 - Standard Specification for Portland Cement; 2007.

K. ASTM C 260 - Standard Specification for Air-Entraining Admixtures for Concrete; 2006.

L. ASTM C 979 - Standard Specification for Pigments for Integrally Colored Concrete; 2005.

M. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2010.

N. AWS D1.4/D1.4M - Structural Welding Code - Reinforcing Steel; American Welding Society; 2005.

O. PCI MNL-117 - Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products; Precast/Prestressed Concrete Institute; 2005.

P. PCI MNL-120 - PCI Design Handbook – Precast and Prestressed Concrete; Precast/Prestressed Concrete Institute; Sixth Edition, 2004.

Q. PCI MNL-122 - Architectural Precast Concrete; Precast/Prestressed Concrete Institute; 2007, Third Edition.

R. PCI MNL-123 - Design and Typical Details of Connections for Precast and Prestressed Concrete; Precast/Prestressed Concrete Institute; 1988, Second Edition.

S. PCI MNL-135 - Tolerance Manual for Precast and Prestressed Concrete Construction; Precast/Prestressed Concrete Institute; 2000.

1.4 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate layout, unit locations, configuration, unit identification marks, reinforcement, connection details, support items, location of lifting devices, dimensions, openings, and relationship to adjacent materials. Provide erection drawings.

C. Samples: Submit two samples, 6" x 6" in size, illustrating surface finish, color and texture.

1.5 QUALITY ASSURANCE

A. Perform the work of this section in accordance with PCI MNL-117, PCI MNL-120, PCI MNL-122, PCI MNL-123, PCI MNL-135, and ACI 318. Perform welding in accordance with AWS D1.1.

B. Fabricator Qualifications:
1. Firm having at least 2 years of documented experience in production of precast concrete of the type required.

C. Welder: Qualified within previous 12 months in accordance with AWS D1.1 and AWS D1.4.

D. Copies of Documents at Project Site: Maintain at the project site a copy of each referenced document that prescribes execution requirements.

1.6 MOCK-UP

A. Include mock-up panel with masonry wall mock-up.

B. Locate where directed.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Handling: Lift and support precast units only from support points.

B. Blocking and Lateral Support During Transport and Storage: Use materials that are clean, non-staining, and non-harmful to exposed surfaces. Provide temporary lateral support to prevent bowing and warping.

C. Protect units to prevent staining, chipping, or spalling of concrete.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Architectural Precast Concrete:
1. A y manufacturer holding a PCI Group A Plant Certification for the types of products specified; see www.pci.org.
2. Georgia Precast Services (Added by Addendum No. 2).
3. Substitutions: See Section 01600 - Product Requirements.

2.2 PRECAST UNITS

A. Precast Architectural Concrete Units: Comply with PCI MNL-120, PCI MNL-122, PCI MNL-123, PCI MNL-135, and ACI 318.
1. Design Loads: Static loads, anticipated dynamic loading, including positive and negative wind loads, thermal movement loads, and erection forces as defined by applicable code.
2. Calculate structural properties of units in accordance with ACI 318.
3. Accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.
4. Provide connections that accommodate building movement and thermal movement and adjust to misalignment of structure without unit distortion or damage.

2.3 REINFORCEMENT

A. Reinforcing Steel: ASTM A 615/A 615M Grade 40 (280).
1. Deformed billet-steel bars.
2. Unfinished.

2.4 CONCRETE MATERIALS

A. Cement: ASTM C 150, Type I - Normal Portland type.

B. Fine and Coarse Structural Aggregates: ASTM C 33.

C. Color Additives: Pure, concentrated mineral pigments specifically intended for mixing into concrete and complying with ASTM C 979.
1. Color(s): As indicated on drawings.

D. Water: Clean and not detrimental to concrete.

E. Air Entrainment Admixture: ASTM C 260.

F. Grout:
1. Non-shrink, non-metallic, minimum 10,000 psi, 28 day strength.

2.5 SUPPORT DEVICES

A. Connecting and Support Devices: ASTM A 36/A 36M steel; hot-dip galvanized in accordance with ASTM A153/A 153M.
1. Clean surfaces of rust, scale, grease, and foreign matter.
2. Galvanize after fabrication in accordance with requirements of ASTM A 123/A 123M.

B. Bolts, Nuts, and Washers: ASTM 307 heavy hex bolts, Type A, hot-dip galvanized, with matching ASTM A 563 (A 563M) nuts and matching washers.

C. Primer: Zinc rich type.

2.6 ACCESSORIES

A. Bearing Pads: High density plastic; 1/8 inch thick, smooth both sides.

B. Reglets: Specified in Section 07620.

C. Sealant: Type specified in Section 07900.

2.7 MIX

A. Concrete: Minimum 5000 psi, 28 day strength, air entrained to 5 to 7 percent in accordance with ACI 301.

2.8 FABRICATION

A. Fabricate in conformance with PCI MNL-117 and PCI MNL-135.

B. Maintain plant records and quality control program during production of precast units. Make records available upon request.

C. Use rigid molds, constructed to maintain precast unit uniform in shape, size, and finish.

D. Maintain consistent quality during manufacture.

E. Fabricate connecting devices, plates, angles, items fit to steel framing members, inserts, bolts, and accessories. Fabricate to permit initial placement and final attachment.

F. Embed reinforcing steel, anchors, inserts plates, angles, and other cast-in items.

G. Place recessed flashing reglets continuous and straight.

H. Cure units to develop concrete quality, and to minimize appearance blemishes such as non-uniformity, staining, or surface cracking.

I. Minor patching in plant is acceptable, providing structural adequacy and appearance of units is not impaired.

J. Finish: Ensure exposed-to-view finish surfaces of precast units are uniform in color and appearance.

K. Clean surfaces of rust, scale, grease, and foreign matter.

L. Prime paint in one coat, except surfaces in direct contact with concrete or requiring field welding.

M. Galvanize after fabrication in accordance with requirements of ASTM A 123/A 123M.

N. Prime paint in one coat, except surfaces in direct contact with concrete or requiring field welding.

2.9 FABRICATION TOLERANCES

A. Conform to PCI MNL-117 and PCI MNL-135, except as specifically amended below.
1. Maximum Variation From Nominal Face Dimensions: Plus or minus 3/32 in.
2. Maximum Variation From Square or Designated Skew: Plus or minus 1/8 inch in 10 feet.
3. Maximum Variation from Thickness: Plus or minus 1/8 in.
4. Maximum Misalignment of Anchors, Inserts, Openings: Plus or minus 1/8 inch.
5. Maximum Bowing of Members: Plus or minus length/360.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Verify that building structure, anchors, devices, and openings are ready to receive work of this section.

3.2 PREPARATION

A. Provide for erection procedures and induced loads during erection. Maintain temporary bracing in place until final support is provided.

3.3 ERECTION

A. Erect units without damage to shape or finish. Replace or repair damaged panels.

B. Erect units level and plumb within allowable tolerances.

C. Align and maintain uniform horizontal and vertical joints as erection progresses.

D. Weld units in place. Perform welding in accordance with AWS D1.1.

E. Touch-up field welds and scratched or damaged primed painted surfaces.

F. Set vertical units dry, without grout, attaining joint dimension with lead or plastic spacers. Pack grout to base of unit.

G. Exposed Joint Dimension: 1/2 inch. Adjust units so that joint dimensions are within tolerances. All mortar joints shall be raked back 3/4" and sealed with approved sealant matching precast.

H. All mortar joints shall be raked back 3/4" and sealed with approved sealant matching precast.

I. Seal perimeter and intermediate joints in accordance with Section 07900.

3.4 TOLERANCES

3.5 REPAIRS

A. Repair architectural precast concrete units if permitted by Architect. The Architect reserves the right to reject repaired units that do not comply with requirements.

B. Precast concrete manufacturer should develop appropriate repair mixtures and techniques during production sample approval process.

C. Mix patching materials and repair units so cured patches blend with color, texture, and uniformity of adjacent exposed surfaces and show no apparent line of demarcation between original and repaired work, when viewed in typical daylight illumination from a distance of 20 feet (6 m).

D. Prepare and repair damaged galvanized coatings with galvanizing repair paint according to ASTM A 780.

END OF SECTION 03451

SECTION 03455 - GLASS-FIBER-REINFORCED CONCRETE

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Architectural precast glass-fiber-reinforced concrete cornices and columns.

B. Supports, anchors, and attachments.

1.2 RELATED REQUIREMENTS

A. Section 04810 - Unit Masonry Assemblies: Placement of anchors specified in this section.

B. Section 05120 - Structural Steel: Placement of anchors specified in this section.

C. Section 05400 - Cold Formed Metal Framing: Structural stud members.

D. Section 06100 - Rough Carpentry: Placement of anchors specified in this section.

E. Section 07900 - Joint Sealers: Application of backer rods or bond breakers and joint sealers.

1.3 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2008

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

C. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength; 2009a.

D. ASTM A325M - Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Tensile Strength (Metric); 2009.

E. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts; 2007a.

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

G. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2010.

H. ASTM C33 - Standard Specification for Concrete Aggregates; 2011.

I. ASTM C150 - Standard Specification for Portland Cement; 2011.

J. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2010.

K. PCI MNL-128 - Recommended Practice for Glass Fiber Reinforced Concrete Panels; Precast/Prestressed Concrete Institute; 2001, Fourth Edition.

1.4 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate locations, fabrication details, reinforcement, metal framing details, connection details, dimensions, and relationship to adjacent materials. Provide erection drawings.

C. Samples: Submit two samples 6 inch by 6 inch in size illustrating surface color, finish and texture.

D. Manufacturer's Installation Instructions: Indicate surface cleaning instructions.

E. Designer Qualifications.

1.5 QUALITY ASSURANCE

A. Designer Qualifications: Design units under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in Alabama.

B. Maintain plant records and quality control program during production of units. Make records and access to plant available to Architect upon request.

1.6 PROJECT CONDITIONS

A. Coordinate the Work with installation of backup supporting structure, windows.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Handle units to position, consistent with their shape and design. Lift and support only from support points.

B. Lifting Device: Capable of maintaining unit shape during manufacture, storage, transportation, erection, and in position for fastening.

C. Blocking and Lateral Support During Transport and Storage: Clean, non-staining, without causing harm to exposed surfaces. Provide temporary lateral support to prevent bowing and warping. Place spacers in same location during transport and site storage.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Glass-Fiber-Reinforced Concrete:
1. Plastrglas, Inc: www.plastrglas.com.
2. Stromberg Architectural Products, Inc: www.strombergarchitectural.com.
3. Substitutions: See Section 01600 - Product Requirements.

2.2 GLASS-FIBER-REINFORCED CONCRETE UNITS

A. Glass-Fiber-Reinforced Concrete Units: Factory-fabricated, complying with PCI MNL-128, using rigid molds, constructed to maintain unit panel uniform in shape, size and finish.
1. Design and fabricate to comply with applicable code(s).
2. Design to withstand dead loads, positive and negative wind loads, and erection forces.
3. Control deflection of units to maintain fit with adjacent construction and openings within their tolerances.
4. Design connections to accommodate building movement without damage to components, wracking of joint connections, breakage of seals, or moisture penetration.
5. Allow for adjustment of connections to accommodate misalignment of structure without permanent distortion.
6. Concrete Mix: Of strength to accommodate panel configuration, panel size and weight, and manufacturing criteria, air entrained.
7. Welding: Comply with AWS D1.1.
8. Appearance: Ensure exposed-to-view finish surfaces of units are uniform in color and appearance.

2.3 CONCRETE MATERIALS

A. Cement: ASTM C150 Portland Type I - Normal; white color.

B. Concrete Aggregates: ASTM C33.

C. Reinforcement: Alkali resistant chopped glass fiber rovings specifically formulated for use in concrete, with lengths varying from 1-1/2 to 2 inches.

2.4 FRAMING MATERIALS

A. Metal Framing Members: Formed from hot-dipped galvanized steel sheet, ASTM A653/A653M, SS Grade 50 (340) Class 1, with G90/Z275 coating.

2.5 SURFACE FINISH MATERIALS

A. Surface Finish Aggregate: Conforming to sample available for inspection at office of Architect.

2.6 SUPPORT DEVICES

A. Connecting and Support Devices: ASTM A36/A36M steel; hot-dip galvanized in accordance with ASTM A153/A153M.

B. Bolts, Nuts, and Washers: ASTM A325 (A 325M) heavy hex structural bolts, Type 1, plain, with matching ASTM A563 (A 563M) nuts, and washers as follows:

C. Primer: Zinc rich oil alkyd.

2.7 FABRICATION

A. Spray-up concrete mix in multiple passes; maintain consistent quality during manufacture.

B. Place metal framing members in position in mold.

C. Embed anchors, inserts, plates, angles, and other cast-in items as indicated on shop drawings.

D. Fabricate connecting devices, items fit to framing members, fasteners and accessories necessary for proper installation.

E. Locate hoisting devices to permit device removal after erection.

F. Cure units to minimize appearance blemishes such as non-uniformity, staining or surface cracking.

G. Identify each unit with corresponding code on erection drawings, in location not visible in finish work.

H. Exposed Non-Galvanized Steel Components: Clean surfaces of rust, scale, grease, and foreign matter; prime paint in one coat, except surfaces in direct contact with concrete or requiring field welding.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that building structure, anchors, devices, and openings are ready to receive work of this section.

3.2 PREPARATION

A. Provide for erection procedures and induced loads during erection. Maintain temporary bracing in place until final support is provided.

3.3 ERECTION

A. Coordinate installation with that of structural supports, backup, and opening framing, if any.

B. Erect units without damage to shape or finish. Replace or repair damaged panels.

C. Erect units level and plumb within allowable tolerances.

D. Align and maintain uniform horizontal and vertical joints as erection progresses.

E. Fasten units in place with mechanical connections.

3.4 TOLERANCES

A. Maximum Variation from Plane of Location: 1/4 inch in 10 feet and 3/8 inch in 100 feet, non-cumulative.

B. Maximum Offset from True Alignment Between Two Connecting Units: 1/4 inch.

C. Maximum Out of Square: 1/8 inch in 10 feet, non-cumulative.

D. Variation From Dimensions Indicated on Shop Drawings: Plus or minus 1/8 inch.

E. Maximum Misalignment of Anchors, Inserts, Openings: 1/8 inch.

F. Bowing of Units: Length of Unit/ 360.

3.5 PROTECTION

A. Protect installed units from damage.

END OF SECTION 03455

SECTION 04810 - UNIT MASONRY ASSEMBLIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Concrete Block.

B. Clay Facing Brick.

C. Mortar and Grout.

D. Reinforcement and Anchorage.

E. Flashings.

F. Lintels.

G. Accessories.

1.2 RELATED REQUIREMENTS

A. Section 05500 - Metal Fabrications: Loose steel lintels.

B. Section 07115 - Bituminous Dampproofing: Dampproofing masonry surfaces.

C. Section 07212 - Board and Batt Insulation: Insulation for cavity spaces.

D. Section 07840 - Firestopping: Firestopping at penetrations of fire-rated masonry and at top of fire-rated walls.

E. Section 07900 - Joint Sealers: Backing rod and sealant at control and expansion joints.

1.3 REFERENCE STANDARDS

A. ACI 530/ASCE 5/TMS 402 - Building Code Requirements for Masonry Structures; American Concrete Institute International; 2008.

B. ACI 530.1/ASCE 6/TMS 602 - Specification For Masonry Structures; American Concrete Institute International; 2008.

C. ASTM A 82/A 82M - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement; 2007.

D. ASTM A 153/A 153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

E. ASTM A 641/A 641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire; 2009a.

F. ASTM C 91 - Standard Specification for Masonry Cement; 2005.

G. ASTM C 144 - Standard Specification for Aggregate for Masonry Mortar; 2004.

H. ASTM C 150 - Standard Specification for Portland Cement; 2007.

I. ASTM C 207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2006.

J. ASTM C 216 - Standard Specification for Facing Brick (Solid Masonry Units Made From Clay or Shale); 2007a.

K. ASTM C 270 - Standard Specification for Mortar for Unit Masonry; 2008a.

L. ASTM C 404 - Standard Specification for Aggregates for Masonry Grout; 2007.

M. ASTM C 979 - Standard Specification for Pigments for Integrally Colored Concrete; 2005.

N. ASTM D 226 - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing; 2006.

O. UL (FRD) - Fire Resistance Directory; Underwriters Laboratories Inc.; current edition.

1.4 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for masonry units, fabricated wire reinforcement, mortar, and masonry accessories.

C. Samples for Initial Selection: Submit four samples of facing brick units in small-scale form showing the full range of colors and textures available for each different exposed masonry unit required.

D. Samples for Verification: Full-size units for each different exposed masonry unit required, showing the full range of exposed colors, textures, and dimensions to be expected in the completed construction.

E. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:

1. Each type of masonry unit required.
   a. Include size-variation data for brick, verifying that actual range of sizes falls within specified tolerances.
2. Each material and grade indicated for reinforcing bars.
3. Each type and size of joint reinforcement.
4. Each type and size of anchor, tie, and metal accessory.

1.5 QUALITY ASSURANCE

A. Comply with provisions of ACI 530/ASCE 5/TMS 402 and ACI 530.1/ASCE 6/TMS 602, except where exceeded by requirements of the contract documents.

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

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

D. Fire Rated Assemblies: Conform to applicable code for requirements for fire rated masonry construction. Where indicated, provide materials and construction identical to those of assemblies with fire-resistance ratings determined per ASTM E 119 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by another means, as acceptable to authorities having jurisdiction.

1.6 MOCK-UP

A. Construct a masonry wall as a mock-up panel sized 8 feet long by 6 feet high; include mortar and accessories and structural backup in mock-up.

B. Mockups: Before installing unit masonry, build mockups to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for the completed Work:

1. Locate mockups in the locations as directed by Architect.
2. Build mockups for the following types of masonry in sizes approximately 48 inches long by 48 inches high by full thickness, including face and backup wythes and accessories. Include a sealant-filled joint at least 16 inches long in each mockup.
   a. Each type of exposed unit masonry construction.
   b. Typical exterior wall with through-wall flashing installed for a 24-inch length in corner of mockup approximately 16 inches down from top of mockup, with a 12- inch length of flashing left exposed to view (omit masonry above half of flashing).

c. Typical exterior masonry-veneer wall complete with concrete masonry units, damproofing, veneer ties, flashing, mortar netting, and weep holes.

d. Typical interior unit masonry wall.

3. Clean exposed faces of mockups with masonry cleaner as indicated.

4. Notify Architect seven days in advance of dates and times when mockups will be constructed.

5. Protect accepted mockups from the elements with weather-resistant membrane.

6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.

7. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.

a. Approval of mockups is also for other material and construction qualities specifically approved by Architect in writing.

b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups, unless such deviations are specifically approved by Architect in writing.

8. Demolish and remove mockups when directed.

C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Contractor shall take all notes and records. Contractor shall issue reports to all attendees including, but not limited to, the Architect, Owner, Sub-contractors, and Water Proofing Consultant to the Owner. Provide a minimum of 7 days notice to all parties prior meeting.

1.7 DELIVERY, STORAGE, AND HANDLING

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

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

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

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

1.8 PROJECT CONDITIONS

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

1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading a thick layer of hay on ground. Maintain hay until finish landscaping is in place.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.

E. Hot-Weather Requirements: Protect unit masonry work when temperature and humidity conditions produce excessive evaporation of water from mortar and grout. Provide artificial shade and wind breaks and use cooled materials as required.

1. When ambient temperature exceeds 100 deg F, or 90 deg F with a wind velocity greater than 8 mph, do not spread mortar beds more than 48 inches ahead of masonry. Set masonry units within one minute of spreading mortar.

PART 2 - PRODUCTS

2.1 CONCRETE MASONRY UNITS

A. General: Provide special shapes for lintels, corners, jambs, sash, control joints, headers, bonding, and other special conditions.

B. Concrete Block: ASTM C 90 and as follows:

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi.
2. Weight Classification: Lightweight or Medium weight.
3. Provide Type I or II units.
4. Size (Width): Manufactured to the following dimensions:
   a. 4 inches nominal; 3-5/8 inches actual.
   b. 6 inches nominal; 5-5/8 inches actual.
   c. 8 inches nominal; 7-5/8 inches actual.
   d. 10 inches nominal; 9-5/8 inches actual.
   e. 12 inches nominal; 11-5/8 inches actual.

2.2 CONCRETE OR MASONRY LINTELS

A. General: Provide either concrete or masonry lintels, at Contractor's option, complying with requirements below.

B. Concrete Lintels: Precast units made from concrete matching concrete masonry units in color, texture, and compressive strength and with reinforcing bars indicated or required to support loads indicated. Cure precast lintels by same method used for concrete masonry units.

C. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam concrete masonry units with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in- place lintels until cured.

2.3 BRICK UNITS

A. General: Provide shapes indicated and as follows for each form of brick required:
1. Provide units without cores or frogs and with exposed surfaces finished for ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces.

B. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.
1. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.
2. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.

C. Manufacturers:
1. Boral Bricks, Inc: www.boralbricks.com.
2. Endicott Clay Products Co: www.endicott.com.
3. General Shale Brick: www.generalshale.com.
4. Jenkins Brick: www.jenkinsbrick.com.
5. Substitutions: See section 01600 - Product requirements.

D. Facing Brick: ASTM C 216, Type FBS, Grade SW.
1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 3000 psi.
2. Initial Rate of Absorption: Less than 20 g/30 sq. in. per minute when tested per ASTM C 67.
3. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."

4. Size (Actual Dimensions): 3-5/8 inches wide by 2-1/4 inches high by 7-5/8 inches long.
5. Application: Use where brick is exposed, unless otherwise indicated.
6. Product/Color:
   a. Brick No. 1: Provide face brick equal to General Shale "Red Range Semi-Smooth" brick. Any proposed substitutions shall be submitted to and approved by Architect prior to bidding in order to be considered for use on this project.

2.4 MORTAR AND GROUT MATERIALS

A. Masonry Cement: ASTM C 91, Type N.
1. Jenkins Brick Co. “Cherokee Red” (Brick), 201 6th Street North,Montgomery,AL36104
2. Colored mortar: Premixed cement as required to match Architect's color sample.

B. Portland Cement: ASTM C 150, Type I; color as required to produce approved color sample.

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

D. Mortar Aggregate: ASTM C 144, except for joints less than 1/4 inch thick, use aggregate

E. Grout Aggregate: ASTM C 404.

F. Pigments for Colored Mortar: Pure, concentrated mineral pigments specifically intended for mixing into mortar and complying with ASTM C 979.
1. Color(s): Equal to LaFarge "Sahara".

G. Water: Clean and potable.

2.5 REINFORCING STEEL

A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M; ASTM A 616/A 616M, including Supplement 1; or ASTM A 617/A 617M, Grade 60.

2.6 REINFORCEMENT AND ANCHORAGE

A. Manufacturers of Joint Reinforcement and Anchors:
1. Dur-O-Wal: www.dur-o-wal.com.
2. Hohmann & Barnard, Inc: www.h-b.com.
3. Masonry Reinforcing Corporation of America: www.wirebond.com.
4. Substitutions: See Section 01600 - Product Requirements.

B. Joint Reinforcement: Use ladder type joint reinforcement where vertical reinforcement is involved and truss type elsewhere, unless otherwise indicated.

C. Single Wythe Joint Reinforcement: Truss type; ASTM A 82/A 82M steel wire, mill galvanized to ASTM A 641/A 641M, Class 3; 0.1483 inch side rods with 0.1483 inch cross rods; width as required to provide not more than 1 inch and not less than 1/2 inch of mortar coverage on each exposure.

D. Multiple Wythe Joint Reinforcement: Truss type; fabricated with moisture drip; ASTM A 82/A 82M steel wire, hot dip galvanized after fabrication to ASTM A 153/153M, Class B; 0.1483 inch side rods with 0.1483 inch cross rods; width as required to provide not more than 1 inch and not less than 1/2 inch of mortar coverage on each exposure.

E. Adjustable Multiple Wythe Joint Reinforcement: Truss type with adjustable ties or tabs spaced at 16 in on center and fabricated with moisture drip; ASTM A 82/A 82M steel wire, hot dip galvanized after fabrication to ASTM A 153/153M, Class B; 0.1875 inch side rods with 0.1483 inch cross rods and adjustable components of 0.1875 inch wire; width of components as required to provide not more than 1 inch and not less than 1/2 inch of mortar coverage from each masonry face.

1. Vertical adjustment: Not less than 2 inches.
2. Insulation Clips: Provide clips at tabs or ties designed to secure insulation against outer face of inner wythe of masonry.

F. Flexible Anchors: 2-piece anchors that permit differential movement between masonry and building frame, sized to provide not more than 1 inch and not less than 1/2 inch of mortar coverage from masonry face.

1. Steel frame: Crimped wire anchors for welding to frame, 0.25 inch thick, with trapezoidal wire ties 0.1875 inch thick, hot dip galvanized to ASTM A 153/A 153M, Class B.

G. Two-Piece Wall Ties: Formed steel wire, 0.1875 inch thick, adjustable, eye and pintle type, hot dip galvanized to ASTM A 153/A 153M, Class B, sized to provide not more than 1 inch and not less than 1/2 inch of mortar coverage from masonry face and to allow vertical adjustment of up to 1-1/4 in.

H. Masonry Veneer Anchors: 2-piece anchors that permit differential movement between masonry veneer and structural backup, hot dip galvanized to ASTM A 153/A 153M, Class B.

1. Anchor plates: Not less than 0.075 inch 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 thick.
3. Vertical adjustment: Not less than 3-1/2 inches.

2.7 MISCELLANEOUS ANCHORS

A. Anchor Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153, Class C; of diameter and length indicated and in the following configurations:

1. Non-headed bolts.
2. Usually delete paragraph below and include in Sections covering items anchored.

B. Postinstalled Anchors: Anchors as described below, with capability to sustain, without failure, load imposed within factors of safety indicated, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

1. Type: Expansion anchors.
2. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (5 microns) for Class SC 1 service condition (mild).
3. For Postinstalled Anchors in Concrete: Capability to sustain, without failure, a load equal to four times the loads imposed.
4. For Postinstalled Anchors in Grouted Masonry Units: Capability to sustain, without failure, a load equal to six times the loads imposed.

2.8 FLASHINGS

A. Metal Flashing: Provide metal flashing, where flashing is exposed or partly exposed and where indicated, complying with SMACNA's "Architectural Sheet Metal Manual, Division 7 Section "Sheet Metal Flashing and Trim" and as follows:

1. Stainless Steel: ASTM A 240/A 240M, Type 304, 0.016 inch thick.
2. Fabricate flashing with drip edge where indicated. Fabricate by extending flashing 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.

B. Flexible Flashing: For flashing not exposed to the exterior, use the following, unless otherwise indicated:

1. Elastomeric Thermoplastic Flashing: Composite flashing product consisting of a polyester-reinforced ethylene interpolymer alloy as follows:
   a. Monolithic Sheet: Elastomeric thermoplastic flashing, 0.040 inch thick.
   b. Products: Provide flexible flashing equal to Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Perm-A-Barrier Wall Flashing.

C. Solder and Sealants for Sheet Metal Flashings:

1. Solder for Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.
2. Elastomeric Sealant: ASTM C 920, chemically curing urethane sealant in concealed locations, except use neutral-curing silicone at all stainless steel splices and bedding, and silicone sealant in exposed locations; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight. See Section 07900 - “Joint Sealants” for each type sealant and manufacturers product numbers.

D. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

E. Flashing Termination Bar: Provide 1/8-inch by 1-inch galvanized steel bars fastened to substrate a maximum of 8-inches on center. Use of powder-actuated fasteners is prohibited.

2.9 ACCESSORIES

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

B. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type II (No. 30 asphalt felt).

C. Weep/Vent Products: Use the following, unless otherwise indicated:
1. Rectangular Plastic Weep/Vent Tubing: Clear butyrate, 3/8 by 1-1/2 by 3-1/2 inches long.
a. Products: Provide vents equal to Dayton Superior Corporation, Dur-O-Wal Division; Cell Vents.

D. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
1. Provide one of the following configurations:
a. Strips, full-depth of cavity and 10 inches wide, with dovetail shaped notches 7 inches deep that prevent mesh from being clogged with mortar droppings.
2. Products:
a. Mortar Break; Advanced Building Products, Inc.
b. CavClear Masonry Mat; CavClear.
c. Mortar Net; Mortar Net USA, Ltd.
d. Mortar Stop; Polytite Manufacturing Corp.

E. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells with loops for holding reinforcing bars in center of cells. Units are formed from 0.142-inch steel wire, hot-dip galvanized after fabrication.
1. Provide units with either two loops or four loops as needed for number of bars indicated.
2. Available Products: Subject to compliance with requirements, materials that may be incorporated into the Work include, but are not limited to, the following:
a. Dayton Superior Corporation, Dur-O-Wal Division; D/A 810, D/A 812 or D/A 817.
b. Heckmann Building Products Inc.; No. 376 Rebar Positioner.
c. Hohmann & Barnard, Inc.; #RB or #RB-Twin Rebar Positioner.
d. Wire-Bond; O-Ring or Double O-Ring Rebar Positioner.

F. Preformed Control Joints: Rubber material. Provide with corner and tee accessories, fused joints.

G. Building Paper: ASTM D 226, Type I ("No.15") asphalt felt.

H. Nailing Strips: Softwood lumber, preservative treated for moisture resistance, dovetail shape, sized to masonry joints.

2.10 MASONRY CLEANERS

A. Job-Mixed Detergent Solution: Solution of 1/2-cup dry measure tetrasodium polyphosphate and 1/2-cup dry measure laundry detergent dissolved in 1 gal. of water.

B. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

1. Manufacturers:
   a. Diedrich Technologies, Inc.
   b. EaCo Chem, Inc.
   c. ProSoCo, Inc.

C. Ground Faced Masonry Cleaner:

1. Equal to Burnished Custom Masonry Cleaner by PROSOCO (dilute 1 part to 3 parts clean water). Do not powerwash.

2.11 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.
2. Limit cementitious materials in mortar to Portland cement and lime.
3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Mortar for Unit Masonry: ASTM C 270, using the Proportion Specification and ASTM C 1142 for ready-mixed mortar.

1. Provide Type N for unit masonry above grade, Type S for reinforced masonry and Type M for unit masonry below grade.

C. Colored Mortar: Proportion selected pigments and other ingredients to match Architect's sample, without exceeding manufacturer's recommended pigment-to-cement ratio.

D. Grout for Unit Masonry: Comply with ASTM C 476.

1. Use grout of type (fine or coarse) that will comply with Table 5 of ACI 530.1/ASCE 6/ TMS 602 for dimensions of grout spaces and pour height.
2. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143.

PART 3 - EXECUTION

3.1 PREPARATION

A. Direct and coordinate placement of metal anchors supplied for installation under other sections.

B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

3.2 COLD AND HOT WEATHER REQUIREMENTS

A. Maintain materials and surrounding air temperature to minimum 40 degrees F prior to, during, and 48 hours after completion of masonry work.

B. Maintain materials and surrounding air temperature to maximum 90 degrees F prior to, during, and 48 hours after completion of masonry work.

3.3 INSTALLATION, GENERAL

A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.

B. Build chases and recesses to accommodate items specified in this and other Sections.

C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.

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

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

F. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.

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

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

3.4 LAYING MASONRY WALLS

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

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

C. Lay concealed masonry with all units in a wythe in running bond. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

D. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

F. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.

G. Fill cores in hollow concrete masonry units with grout 24 inches under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.

H. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above, unless otherwise indicated.

1. Install compressible filler in joint between top of partition and underside of structure above.
2. Wedge non-load-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.
3. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Division 7 Section "Firestopping."

3.5 MORTAR BEDDING AND JOINTING

A. Lay hollow concrete masonry units as follows:

1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.

B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.

D. Cut joints flush for masonry walls to remain concealed, unless otherwise indicated.

3.6 COMPOSITE MASONRY

A. Bond wythes of composite masonry together using one of the following methods:

1. Individual Metal Ties: Provide ties as shown installed in horizontal joints, but not less than one metal tie for 4.5 sq. ft. of wall area spaced not to exceed 24 inches o.c. horizontally and 16 inches o.c. vertically. Stagger ties in alternate courses. Provide additional ties within 12 inches of openings and space not more than 36 inches apart around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24 inches o.c. vertically.
   a. Where bed joints of wythes do not align, use adjustable (two-piece) type ties.
2. Masonry Joint Reinforcement: Installed in horizontal mortar joints.
   a. Where bed joints of both wythes align, use ladder-type reinforcement extending across both wythes.

B. Bond wythes of composite masonry together using bonding system indicated on Drawings.

C. Collar Joints: Solidly fill collar joints by parging face of first wythe that is laid and shoving units of other wythe into place.

D. Corners: Provide interlocking masonry unit bond in each wythe and course at corners, unless otherwise indicated.

1. Provide continuity with masonry joint reinforcement at corners by using prefabricated L-shaped units as well as masonry bonding.

E. Intersecting and Abutting Walls: Unless vertical expansion or control joints are shown at juncture, bond walls together as follows:

1. Provide individual metal ties not more than 16 inches o.c.
2. Provide continuity with masonry joint reinforcement by using prefabricated T-shaped units.
3. Provide rigid metal anchors not more than 24 inches o.c. If used with hollow masonry units, embed ends in mortar-filled cores.

3.7 CAVITY WALLS

A. Bond wythes of cavity walls together using one of the following methods:

1. Individual Metal Ties: Provide ties as shown installed in horizontal joints, but not less than one metal tie for 4.5 sq. ft. of wall area spaced not to exceed 24 inches o.c. horizontally and 16 inches o.c. vertically. Stagger ties in alternate courses. Provide additional ties within 12 inches of openings and space not more than 36 inches apart around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24 inches o.c. vertically.
   a. Where bed joints of wythes do not align, use adjustable (two-piece) type ties.
2. Masonry Joint Reinforcement: Installed in horizontal mortar joints.
   a. Use adjustable (two-piece) type reinforcement.
3. Masonry Veneer Anchors: Comply with requirements for anchoring masonry veneers.

B. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.

C. Coat cavity face of backup wythe to comply with Division 7 Section "Bituminous Dampproofing."

D. Installing Cavity-Wall Insulation: Place small dabs of adhesive, spaced approximately 12 inches o.c. both ways, on inside face of insulation boards, or attach with plastic fasteners designed for this purpose. Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways. Press units firmly against inside wythe of masonry or other construction as shown.

1. Fill cracks and open gaps in insulation with crack sealer compatible with insulation and masonry.

3.8 CONTROL AND EXPANSION JOINTS

A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

B. Form control joints in concrete masonry as follows:

1. Fit bond-breaker strips into hollow contour in ends of concrete masonry units on one side of control joint. Fill resultant core with grout and rake out joints in exposed faces for application of sealant.

C. Form expansion joints in brick made from clay or shale as follows:

1. Form open joint full depth of brick wythe and of width indicated, but not less than 3/8 inch for installation of sealant and backer rod specified in Division 7 Section "Joint Sealants." Use the following guidelines to determine the appropriate joint thickness at any joint indicated on the Drawings based on the longer wall section on either side of the joint.
   a. Less than 20 feet - 3/8-inch joint.
   b. 20 feet to 30 feet - ½ inch joint.
   c. 30 feet to 40 feet - 5/8 inch joint.

D. Provide horizontal, pressure-relieving joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod specified in Division 7 Section "Joint Sealants," but not less than 3/8 inch.

1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.9 LINTELS

A. Install steel lintels where indicated.

B. Provide masonry lintels where shown and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are shown without structural steel or other supporting lintels.

C. Provide minimum bearing of 8 inches at each jamb, unless otherwise indicated.

3.10 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. Install vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.

B. Install flashing as follows, unless otherwise indicated:

1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
2. At cavity walls, extend flashing through outer wythe, across cavity, through the insulation, turned up a minimum of 8 inches on the cavity face of the inner wythe, terminating with termination bar and sealant along top edge of flashing membrane. Provide a sealant formed cant behind flashing where it turns up the wall.
3. At lintels and shelf angles, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.

4. Install metal drip edges in a bed of sealant and beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall and adhere flexible flashing to top of metal drip edge.

C. Install weep holes in head joints in exterior wythes of first course of masonry immediately above embedded flashing and as follows:
1. Use specified weep/vent products to form weep holes.
2. Space weep holes 24 inches o.c., unless otherwise indicated.

D. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in Part 2 "Miscellaneous Masonry Accessories" Article.

3.11 REINFORCED UNIT MASONRY INSTALLATION

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
2. Limit height of vertical grout pours to not more than 60 inches.

3.12 REINFORCED UNIT MASONRY INSTALLATION

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.

1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
2. Limit height of vertical grout pours to not more than 60 inches.

3.13 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
6. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
7. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

3.14 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.

1. Crush masonry waste to less than 4 inches in each dimension.
2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Division 2 Section "Earthwork."

3. Do not dispose of masonry waste as fill within 18 inches of finished grade.

C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

3.15 CLEANING

A. Remove excess mortar and mortar droppings.

B. Replace defective mortar. Match adjacent work.

C. Clean soiled surfaces with cleaning solution.

D. On ground faced masonry, clean the completed walls with special masonry cleaner, strictly following the manufacturer's instructions – including thorough rinsing. Do not use acid or abrasives on the finished surfaces. Failure to strictly follow manufacturer’s instructions can result in permanent damage to the finished faces.

1. For completely finished walls, a finish coat of Acrylic Sealer (minimum 20% solids content). Apply to walls after cleandown and when the walls are dry. Apply the acrylic evenly to cover the entire surface without forming drips or runs. For maximum coverage and best appearance, apply Acrylic with airless spray equipment. Consult manufacturer for further information.

END OF SECTION 04810

SECTION 05120 - STRUCTURAL STEEL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes fabrication and erection of structural steel work, as shown on drawings including schedules, notes, and details showing size and location of members, typical connections, and types of steel required.

B. Related Sections include the following:
1. Division 1 Section "Quality Requirements" for independent testing agency procedures and administrative requirements.
2. Division 5 Section "Steel Deck" for field installation of shear connectors.
3. Division 5 Section "Metal Fabrications" for miscellaneous steel fabrications and other metal items] not defined as structural steel.
4. Division 9 painting Sections for surface-preparation and priming requirements.

1.3 DEFINITIONS

A. Structural Steel: Elements of structural-steel frame, as classified by AISC's "Code of Standard Practice for Steel Buildings and Bridges," that support design loads.

1.4 PERFORMANCE REQUIREMENTS

A. Connections: Provide details of simple shear connections required by the Contract Documents to be selected or completed by structural-steel fabricator, including comprehensive engineering design by a qualified professional engineer, to withstand ASD-service loads and comply with other information and restrictions indicated.
1. Select and complete connections using schematic details indicated and AISC's "Manual of Steel Construction.

B. Construction: Type 2, simple framing

1.5 SUBMITTALS

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

B. Shop Drawings: Show fabrication of structural-steel components.
   1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
   2. Include embedment drawings.
   3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
   4. Submit all shop drawings on one reproducible print and two copies only. The reproducible print will be returned. All copies required by the contractor are the responsibility of the contractor and shall be made after the reproducible isreturned.
   5. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.
   6. For structural-steel connections indicated to comply with design loads, include structural design data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Welding certificates.

D. Mill Test Reports: Signed by manufacturers certifying that the following products comply with requirements:
   1. Structural steel including chemical and physical properties.
   2. Bolts, nuts, and washers including mechanical properties and chemical analysis.
   3. Shop primers.
   4. Nonshrink grout.

E. Source quality-control test reports.

F. LEED Submittal
   1. Product Data for Credit MR 4.1 and Credit MR 4.2: For products having recycled content, documentation indicating percentage by weight of postconsumer and preconsumer recycled content. Include statement indicating costs for each product having recycled content.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD.

B. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."

C. Comply with applicable provisions of the following specifications and documents:
   1. AISC's "Code of Standard Practice for Steel Buildings and Bridges."
   2. AISC's "Seismic Provisions for Structural Steel Buildings" and "Supplement No. 2."
   3. AISC's "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design
   4. AISC's "Specification for the Design of Steel Hollow Structural Sections."
   5. AISC's "Specification for Allowable Stress Design of Single-Angle Members
   6. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from erosion and deterioration.

1. Store fasteners in a protected place. Clean and relubricate bolts and nuts that become dry or rusty before use.
2. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.8 COORDINATION

A. Furnish anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: ASTM A992/A992M, Grade 50.

B. Channels, Angles-Shapes: ASTM A 36/A 36M

C. Plate and Bar: ASTM A 36/A 36M

D. Hollow Structural Sections: ASTM A 500, Grade B, structural tubing.

E. Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy hex steel structural bolts; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.

1. Finish: Hot-dip zinc coating, ASTM A 153/A 153M, Class C.

B. Headed Threaded Rods: ASTM A 307, Grade A.

1. Nuts: ASTM A 563 heavy hex carbon steel.
2. Washers: ASTM A 36/A 36M carbon steel.
3. Finish: Hot-dip zinc coating, ASTM A 153/A 153M, Class C

2.3 PRIMER

A. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer.

2.4 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.5 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC's "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design"

1. Mark and match-mark materials for field assembly.
2. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.

1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.

C. Bolt Holes: Cut, drill, mechanically thermal cut, or punch standard bolt holes perpendicular to metal surfaces.

D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC- SP 1, "Solvent Cleaning."

F. Holes: Provide holes required for securing other work to structural steel and for passage of other work through steel framing members.

1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
2. Base-Plate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.6 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened

B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.

1. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.

2.7 SHOP PRIMING

A. Shop prime steel surfaces except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
2. Surfaces to be field welded.
3. Surfaces to be high-strength bolted with slip-critical connections.
4. Surfaces to receive sprayed fire-resistive materials.
5. Galvanized surfaces.

B. Painting: Apply a 1-coat, nonasphaltic primer complying with SSPC-PS Guide 7.00, "Painting System Guide 7.00: Guide for Selecting One-Coat Shop Painting Systems," to provide a dry film thickness of not less than 1.5 mils.

2.8 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/ A 123M.

1. Fill vent holes and grind smooth after galvanizing.

2.9 SOURCE QUALITY CONTROL

A. Owner will engage an independent testing and inspecting agency to perform shop tests and ins

1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.

B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

C. Bolted Connections: Shop-bolted connections will be inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts." All bolts shall be verified to be in place and be snug tight.

D. Welded Connections: In addition to visual inspection, shop-welded connections will be tested and inspected according to AWS D1.1 and the following inspection procedures, at testing agency's option:

1. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted. Inspect 20% of all fillet welds.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments, with steel erector present, for compliance with requirements.

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

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place, unless otherwise indicated.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design

B. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting base and bearing plates. Clean bottom surface of base and bearing plates.

1. Set base and bearing plates for structural members on wedges, shims, or setting nuts as required.
2. 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 base or bearing plate before packing with grout.
4. Promptly pack grout solidly between bearing surfaces and base or bearing plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

C. Maintain erection tolerances of structural steel and architecturally exposed structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

D. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.
2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

E. Splice members only where indicated.

F. Remove erection bolts on welded, architecturally exposed structural steel; fill holes with plug welds; and grind smooth at exposed surfaces.

G. Do not use thermal cutting during erection unless approved by Architect. Finish thermally cut sections within smoothness limits in AWS D1.1.

H. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.

1. Comply with AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design" for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
3. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.
4. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent weld show- through on exposed steel surfaces.
    a. Grind butt welds flush.
    b. Grind or fill exposed fillet welds to smooth profile. Dress exposed welds.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.

B. Bolted Connections: Shop-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts." All bolts shall be verified to be in place and be snug tight.

C. Welded Connections: Field welds will be visually inspected according to AWS D1.1.
1. In addition to visual inspection, field welds will be tested according to AWS D1.1 and the following inspection procedures, at testing agency's option:
a. Liquid Penetrant Inspection: ASTM E 165.
b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted. Inspect 20% of all fillet welds.

D. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1 for stud welding and as follows:
1. Perform bend tests if visual inspections reveal either a less-than- continuous 360-degree flash or welding repairs to any shear connector.
2. Conduct tests on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1.

E. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.6 REPAIRS AND PROTECTION

A. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists and accessories [bearing plates] and abutting structural steel.
1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.

END OF SECTION 05120

SECTION 05125 - ARCHITECURAL EXPOSED STRUCTURAL STEEL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to the Section.

1.2 SUMMARY

A. This Section includes requirements regarding the appearance and surface preparation of Architecturally Exposed Structural Steel (AESS). Refer to Division 5, Section 'Structural Steel' for all other requirements regarding steel work not included in this section. This section applies to any members noted on Architectural and Structural drawings as AESS and in the areas defined as AESS below.

B. Related Sections: The following Sections contain requirements that relate to this Section:
   1. Division 1 Section “Quality Control” for independent testing agency procedures and administrative requirements.
   2. Division 5 Section “Structural Steel”
   3. Division 5 Section “Steel Joists”
   4. Division 5 Section “Metal Decking” for erection requirements relating to exposed steel decking and its connections
   5. Division 5 Section “Metal Fabrications” for loose steel-bearing plates and miscellaneous steel framing.
   6. Division 9 Section “Painting” for finish coat requirements and coordination with primer and surface preparation specified in this section.

1.3 SUBMITTALS

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

B. Product Data for each type of product specified.

C. Shop Drawings detailing fabrication of AESS components.
   1. Provide erection drawings clearly indicating which members are considered as AESS members.
   2. Include details that clearly identify all of the requirements listed in sections 2.3 “Fabrication” and 3.3 “Erection” of this specification. Provide connections for exposed AESS consistent with concepts shown on the architectural or structural drawings.
   3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length and type of each weld. Identify grinding, finish and profile of welds as defined herein.

4. Indicate type, size, finish and length of bolts, distinguishing between shop and field bolts. Identify high-strength bolted slip-critical, direct-tensioned shear/bearing connections.
5. Clearly indicate which surfaces or edges are exposed and what class of surface preparation is being used.
6. Indicate special tolerances and erection requirements as noted on the drawings or defined herein.

D. Qualification data for firms and persons specified in the 'Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects names and address, names and addresses of architects and owners, and other information specified.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: In addition to those qualifications listed in Division 5 Section 'Structural Steel,' engage a firm experienced in fabricating AESS similar to that indicated for this Project with a record of successful in-service performance, as well as sufficient production capacity to fabricate AESS without delaying the Work.

B. Erector Qualifications: In addition to those qualifications listed in Division 5 Section 'Structural Steel,' engage an experienced Erector who has completed AESS work similar in material, design, and extent to that indicted for this Project and with a record of successful in- service performance.

C. Comply with applicable provisions of the following specifications and documents:
1. AISC "Code of Standard Practice," latest edition,

D. Mockups: At least four weeks prior to fabricating AESS, the contractor shall construct mockups to demonstrate aesthetic effects as well as qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for final unit of Work.
1. Locate mockups on-site or in the fabricator's shop as directed by Architect. Mockups shall be full-size pieces unless the Architect approves smaller models.
2. Notify the Architect one week in advance of the dates and times when mockups will be available for review.
3. Demonstrate the proposed range of aesthetic effects regarding each element listed under the fabrication heading below.
4. Mockup will have finished surface (including surface preparation and paint system).
5. Obtain Architect's approval of mockups before starting fabrication of final units.
6. Retain and maintain mockups during construction in an undisturbed condition as a standard for judging the completed work.
    a. Approved mockups in an undisturbed condition at the time of Substantial completion may become part of the completed work.

E. Pre-installation Conference: The General Contractor shall schedule and conduct conference at the project site to comply with requirements of Division 1 Section "Project Meetings." As a minimum, the meeting shall include the General Contractor, Fabricator, Erector, the finish- painting subcontractor, and the Architect. Coordinate requirements for shipping, special handling, attachment of safety cables and temporary erection bracing, touch up painting and other requirements for AESS.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver AESS to Project site in such quantities an at such times to ensure continuity of installation.

B. Store materials to permit easy access for inspection and identification. Keep steel members off ground by using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration. Use special care in handling to prevent twisting or warping of AESS members.

C. Erect pre-painted finish pieces using padded slings or other methods such that they are not damaged. Provide padding as required to protect while rigging and aligning member's frames. Weld tabs for temporary bracing and safety cabling only at points concealed from view in the completed structure or where approved by the Architect during the pre- installation meeting. Methods of removing temporary erection devices and finishing the AESS members shall be approved by the Architect prior to erection.

1.6 PROJECT CONDITIONS

A. Field Measurements: Where AESS is indicated to fit against walls and other construction, verify dimensions by field measurements before fabrication and indicate measurements on shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the work.

1.7 COORDINATION

A. Coordinate installation of anchors for AESS members that connect to the work of other trades. Furnish setting drawings, templates, and directions for installing anchors, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to the project site in time for installation.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Meet requirements Division 5 Section 'Structural Steel' as amended below.

B. High-Strength Bolts, Nuts, and Washers: Per section 05120 heavy hex heads and nuts Provide rounded bolt heads with twist-off bolts.

2.2 PRIMERS

A. Compatibility: The General Contractor shall submit all components/procedures of the paint system for AESS as a single coordinated submittal. As a minimum, identify required surface preparation, primer, intermediate coat (if applicable) and finish coat. All of the items shall be coordinated with the finish coat specified in Division 9.

B. Primer: Acrylic water-soluble shop coat with good resistance to normal atmospheric corrosion. Primer shall comply with all federal standards for VOC, lead and chromate levels.

2.3 FABRICATION

A. Fabricate and assemble AESS in the shop to the greatest extent possible. Locate field joints in AESS assemblies at concealed locations or as approved by the Architect. Detail AESS assemblies to minimize field handling and expedite erection.

B. Fabricate AESS with exposed surfaces smooth, square and of surface quality consistent with the approved mock up. Use special care in handling and shipping of AESS both before and after shop painting.

C. In addition to special care used to handle and fabricate AESS, employ the following fabrication techniques.

1. Fabrication Tolerance: Fabricate steel to one half the normal tolerance as specified in the Code of Standard Practice Section 10.
2. Welds ground smooth: Fabricator shall grind welds of AESS smooth. For groove welds, the weld shall be made flush to the surfaces each side and be within +1/16”, -0” of plate thickness.
3. Contouring and blending of welds: Where fillet welds are indicated to be ground-contoured, or blended, oversize welds as required and grind to provide a smooth transition and to match profile on approved mock-up.
4. Continuous Welds: Where welding is noted on the drawings, provide continuous welds of a uniform size and profile.
5. Minimize Weld Show Through: At locations where welding on the far side of an exposed connection occurs, grind distortion and marking of the steel to a smooth profile with adjacent material.
6. Coping and Blocking Tolerance: Maintain a uniform gap of 1/8” ± 1/32” at all copes and blocks.
7. Joint Gap Tolerance: Maintain a uniform gap of 1/8” ± 1/32”.
8. Piece Marks Hidden: Fabricate such that piece marks are fully hidden in the final structure or made with such media to permit full removal after erection.
9. Mill Mark Removal: Fabricator shall deliver steel with no mill marks (stenciled, stamped, raised etc) in exposed locations. Mill marks shall be omitted by cutting of mill material to appropriate lengths where possible. Where not possible, the fabricator can fill and/or grind to a surface finish consistent with the approved mock up.
10. Grinding of sheared edges: Fabricator shall grind all edges of sheared, punched or flamecut steel to match approved mockup.
11. Rolled Members: Member specified to be rolled to a final curved shape shall be fully shaped in the shop and tied during shipping to prevent stress relieving. Distortion of the web or stem, and of outstanding flanges or legs of angles shall be visibly acceptable to the Architect from a distance of 20' under any lighting condition determined by the Architect. Tolerances for the vertical and horizontal walls of rectangular HSS members after rolling shall be the specified dimension +/- ½”.
12. Seal weld open ends of round and rectangular hollow structural section with 3/8” closure plates. Provide continuous, sealed welds at angle to gusset-plate connections and similar locations where AESS is exposed to weather.

2.4 SHOP CONNECTIONS

A. Bolted Connections: Make in accordance with Section 05120. Provide bolt type and finish as noted herein and align bolt heads as indicated on the approved shop erection drawings.

B. Weld Connections: Comply with AWS D1.1 and Section 05120. Appearance and quality of welds shall be consistent with the mock up. Assemble and weld built-up sections by methods that will maintain alignment of members without warp exceeding the tolerance of this section.

2.5 SHOP PRIMING

A. Shop-prime steel surfaces, except the following:
1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2".
2. Surfaces to be field welded.
3. Surfaces to be high-strength bolted with slip critical connections, if primer does not meet the specified AISC slip coefficient.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust, loose mill scale, and spatter, slag, or flux deposits. Prepare surfaces according to SSPC Specifications as follows:
1. SSPC-SP 3 "Power Tool Cleaning."

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's instructions to provide a dry film thickness of not less than 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
2. Apply two coats of shop primer to surfaces that are inaccessible after assembly or erection.

PART 3 - EXECUTION

3.1 EXAMINATION

A. The erector shall check all AESS members upon delivery for twist, kinks, gouges or other imperfections which might result in rejection of the appearance of the member. Coordinate remedial action with fabricator prior to erecting steel.

3.2 PREPARATON

A. Provide connections for temporary shoring, bracing and supports only where noted on the approved shop drawings. Temporary connections not shown shall be made at locations not exposed to view in the final structure or as approved by the Architect. Handle, lift and align pieces using padded slings and/or other protection required to maintain the appearance of the AESS through the process of erection.

3.3 ERECTION

A. Set AESS accurately in locations and to elevations indicated, and according to AISC specifications referenced in this Section.

B. In addition to the special care used to handle and erect AESS, employ the following erection techniques:

1. AESS Erection Tolerances: Erection Tolerances shall meet the requirements of Chapter 10 of the AISC Code of Standard Practice.
2. Welds ground smooth: Erector shall grind welds smooth in the connections of AESS members. For groove welds, the weld shall be made flush to the surfaces of each side and be within + 1/16", -0" of plate thickness.
3. Contouring and blending of welds: Where fillet welds are indicated to be ground contoured, or blended, oversize welds as required; grind to provide a smooth transition and to match profile on approved mock-up.
4. Continuous Welds: Where noted on the drawings, provide continuous welds of a uniform size and profile.
5. Minimize Weld Show Through: At locations where welding on the far side of an exposed connection occurs, grind distortion and marking of the steel to a smooth profile with adjacent material.
6. Bolt Head Orientation: All bolt heads shall be oriented as indicated on the contract documents. Where bolt-head alignment is specified, the orientation shall be noted for each connection on the erection drawings. Where not noted, the bolt heads in a given connection shall be oriented to one side.
7. Removal of field connection aids: Run-out tabs, erection bolts and other steel members added to connections to allow for alignment, fit-up, and welding in the field shall be removed from the structure. Field groove welds shall be selected to eliminate the need for backing bars or to permit their removal after welding. Welds at run-out tabs shall be removed to match adjacent surfaces and ground smooth. Holes for erection bolts shall be plug welded and ground smooth.
8. Filling of weld access holes: Where holes must be cut in the web at the intersection with flanges on W shapes and structural tees to permit field welding of the flanges, they shall be filled. Filling shall be executed with proper procedures to minimize restraint and address thermal stresses in group 4 and 5 shapes.

C. Field Welding: Weld profile, quality, and finish shall be consistent with mock-ups approved prior to fabrication.

D. Splice members only where indicated.

E. Obtain permission for any torch cutting or field fabrication from the Architect. Finish sections thermally cut during erection to a surface appearance consistent with the mock up.

F. Do not enlarge unfair holes in members by burning or by using drift pins. Ream holes that must be enlarged to admit bolts. Replace connection plates that are misaligned where holes cannot be aligned with acceptable final appearance.

3.4 FIELD CONNECTIONS

A. Bolted Connections: Install bolts of the specified type and finish in accordance with Division 5 section “Structural Steel.”

B. Welded Connections: Comply with AWS D1.1 for procedures, and appearance. Refer to Division 5 section “Structural Steel” for other requirements.

1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without warp. Verify that weld sizes, fabrication sequence, and equipment used for AESS will limit distortions to allowable tolerances.
2. Obtain Architects approval for appearance of welds in repaired or field modified work.

3.5 FIELD QUALITY CONTROL

A. Structural requirements: The Owner will engage an independent testing and inspecting agency to perform field inspections and tests and to prepare test reports. Refer to Division 5 section “Structural Steel” for detailed bolt and weld testing requirements.

B. AESS acceptance: The Architect shall observe the AESS steel in place and determine acceptability based on the mockup. The Testing Agency shall have no responsibility for enforcing the requirements of this section.

3.6 ADJUSTING AND CLEANING

A. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint shall be completed to blend with the adjacent surfaces of AESS. Such touch up work shall be done in accordance with manufacturer's instructions as specified in Division 9, Section “Painting.”

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780.

END OF SECTION 05125

SECTION 05310 - STEEL DECK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
1. Roof Deck.
2. Composite Floor Deck.

B. Related Sections include the following:
1. Division 03 Section "Cast-in-Place Concrete" for concrete fill.
2. Division 05 Section "Structural Steel Framing" for shop- and field-welded shear connectors.
3. Division 05 Section "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.
4. Division 09 painting Sections for repair painting of primed deck.

1.3 SUBMITTALS

A. Product Data: For each type of deck, accessory, and product indicated.

B. Shop Drawings: Show layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

C. Product Certificates: For each type of steel deck, signed by product manufacturer.

D. Welding certificates.

E. Field quality-control test and inspection reports.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that each of the following complies with requirements:
1. Power-actuated mechanical fasteners.

G. Research/Evaluation Reports: For steel deck.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency qualified according to ASTM E 329 for testing indicated.

B. Welding: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."

C. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural members."

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

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

1. Steel Deck:
   a. ASC Profiles, Inc.
   b. Canam Steel Corp.;The Canam Manac Group.
   c. Consolidated Systems, Inc.
   d. DACS, Inc.
   e. D-Mac Industries Inc.
   f. Epic Metals Corporation.
   g. Marlyn Steel Decks, Inc.
   h. New Millennium Building Systems, LLC.
   i. Nucor Corp.; Vulcraft Division.
   j. Roof Deck, Inc.
   k. United Steel Deck, Inc.
   l. Valley Joist; Division of EBSCO Industries, Inc.
   m. Verco Manufacturing Co.
   n. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.

2.2 ROOF DECK

A. Steel Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 30, and with the following:

1. Galvanized Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33, G90 zinc coating.
2. Deck Profile: Type WR, wide rib.
3. Profile Depth: 1-1/2 inches .
4. Span Condition: Triple span or more.
5. Side Laps: Overlapped or interlocking seam at Contractor's option.

2.3 COMPOSITE FLOOR DECK

A. Composite Steel Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with "SDI Specifications and Commentary for Composite Steel Floor Deck," in SDI Publication No. 30, with the minimum section properties indicated, and with the following:

1. Galvanized Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33, G60 zinc coating.
2. Profile Depth: 2 inches.

2.4 ACCESSORIES

A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.

D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

F. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck, unless otherwise indicated.

G. Piercing Hanger Tabs: Piercing steel sheet hanger attachment devices for use with floor deck.

H. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, 0.0598 inch thick, with factory-punched hole of 3/8-inch minimum diameter.

I. Galvanizing Repair Paint: ASTM A 780 and SSPC-Paint 20 or DOD-P-21035, with dry film containing a minimum of 94 percent zinc dust by weight.

J. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

3.2 INSTALLATION, GENERAL

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 30, manufacturer's written instructions, and requirements in this Section.

B. Install temporary shoring before placing deck panels, if required to meet deflection limitations.

C. Locate deck bundles to prevent overloading of supporting members.

D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.

E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.3 ROOF-DECK INSTALLATION

A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches (38 mm) long, and as follows:

1. Weld Diameter: 5/8 inch, nominal.
2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support. Space welds [18 inches (450 mm) apart, maximum] [12 inches (305 mm) apart in the field of roof and 6 inches (150 mm) apart in roof corners and perimeter.
3. Weld Washers: Install weld washers at each weld location.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of 1/2 of the span or 18 inches (450 mm), and as follows:

1. Mechanically fasten with self-drilling, No. 10 (4.8-mm-) diameter or larger, carbon-steel screws.
2. Fasten with a minimum of 1-1/2-inch- (38-mm-) long welds.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm), with end joints as follows:

1. End Joints: Lapped 2 inches (51 mm) minimum.

D. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and mechanically fasten flanges to top of deck. Space mechanical fasteners not more than 12 inches (305 mm) apart with at least one fastener at each corner.

E. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld or mechanically fasten to substrate to provide a complete deck installation.

1. Weld cover plates at changes in direction of roof-deck panels, unless otherwise indicated.

F. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

3.4 FLOOR-DECK INSTALLATION

A. Fasten floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:

1. Weld Diameter: 5/8 inch, nominal.
2. Weld Spacing: Weld edge ribs of panels at each support. Space additional welds an average of 12 inches apart, but not more than 18 inches apart.
3. Weld Spacing: Space and locate welds as indicated.
4. Weld Washers: Install weld washers at each weld location.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of half of the span or 36 inches, and as follows:

1. Mechanically fasten.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:

1. End Joints: Lapped.

D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations, unless otherwise indicated.

E. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field welds will be subject to inspection.

C. Testing agency will report inspection results promptly and in writing to Contractor and Architect.

D. Remove and replace work that does not comply with specified requirements.

E. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.6 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation, and apply repair paint.

1. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.
2. Wire brushing, cleaning, and repair painting of bottom deck surfaces are included in Division 09 Painting Section.

C. Repair Painting: Wire brushing, cleaning, and repair painting of rust spots, welds, and abraded areas of both deck surfaces are included in Division 09 Painting Section.

D. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05310

SECTION 05400 - COLD FORMED METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Formed steel stud exterior wall and soffit framing.

1.3 RELATED REQUIREMENTS

A. Section 06100 - Rough Carpentry: Wood blocking, sheathing and miscellaneous framing.

B. Section 07212 - Board and Batt Insulation: Insulation within framing members.

C. Section 09260 - Gypsum Board Assemblies: Lightweight, non-load bearing metal stud framing.

1.4 REFERENCE STANDARDS

A. AISI SG02-1 - North American Specification for the Design of Cold-Formed Steel Structural Members; American Iron and Steel Institute; 2001 with 2004 supplement. (replaced SG-971)

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

1.5 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's data on factory-made framing connectors, showing compliance with requirements.

1.6 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads within limits and under conditions indicated.

1. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
    a. Exterior Non-Load-Bearing Framing: Horizontal deflection of 1/240 of the span.

B. Cold-Formed Steel Framing, General: Design according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions."

1. Headers: Design according to AISI's "Standard for Cold-Formed Steel Framing - Header Design."

2. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

1.7 QUALITY ASSURANCE

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

B. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.

C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."

D. Fire-Test-Response Characteristics: Where indicated, provide cold-formed metal framing identical to that of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

E. AISI Specifications and Standards: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and its "Standard for Cold-Formed Steel Framing - General Provisions."

F. Comply with AISI's "Standard for Cold-Formed Steel Framing - Prescriptive Method for One and Two Family Dwellings."

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Metal Framing, Connectors, and Accessories:
1. Clarkwestern Dietrich Building Systems LLC: www.clarkdietrich.com.
2. Marino\Ware: www.marinoware.com.
3. The Steel Network, Inc: www.SteelNetwork.com.
4. Substitutions: See Section 01600 - Product Requirements.

2.2 FRAMING SYSTEM

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

2.3 FRAMING MATERIALS

A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
1. Grade: ST50H.
2. Coating: G90 or equivalent.

B. Framing Connectors: Factory-made formed steel sheet, ASTM A 653/A 653M SS Grade 50, with G60/Z180 hot dipped galvanized coating and factory punched holes.
1. Structural Performance: Maintain load and movement capacity required by applicable code, when evaluated in accordance with AISI North American Specification for the Design of Cold Formed Steel Structural Members; minimum 16 gage, 0.06 inch thickness.
2. Provide non-movement connections for tie-down to foundation, floor-to-floor tie-down, roof-to-wall tie-down, joist hangers, gusset plates, and stiffeners.

2.4 EXTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: 18 ga.
2. Flange widths vary with application. If sheathing or masonry ties are required, consider minimum flange width of 1-5/8 inches (41 mm). Sequence corresponds to new common flange width designators 137, 162, 200, and 250.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges.

C. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure.

2.5 ACCESSORIES

A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:

1. Supplementary framing.
2. Bracing, bridging, and solid blocking.
3. Anchor clips.
4. End clips.
5. Stud kickers, knee braces, and girts.

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

2.6 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.

B. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

C. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.

D. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.

1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

E. Welding Electrodes: Comply with AWS standards.

2.7 FABRICATION

A. Fabricate cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.

1. Fabricate framing assemblies using jigs or templates.
2. Cut framing members by sawing or shearing; do not torch cut.
3. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
    a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.
4. Fasten other materials to cold-formed metal framing by welding, bolting, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.

C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet.

PART 3 - EXECUTIONEXAMINATION

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

B. Verify field measurements and adjust installation as required.

3.2 PREPARATION

A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.

B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire- resistive materials below that are required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.

C. Install load bearing shims or grout between the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations to ensure a uniform bearing surface on supporting concrete or masonry construction.

D. Install sealer gaskets to isolate the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

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

B. Install cold-formed metal framing according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions" and to manufacturer's written instructions unless more stringent requirements are indicated.

C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.

D. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened.
1. Cut framing members by sawing or shearing; do not torch cut.
2. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
b. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.

E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

G. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.

H. Install insulation, specified in Division 7 Section "Building Insulation," in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

I. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.

J. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.4 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.

B. Fasten both flanges of studs to top and bottom track, unless otherwise indicated. Space studs as follows:

1. Stud Spacing: 16 inches.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.

E. Install horizontal bridging in wall studs, spaced in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.

1. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.

F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable wall-framing system.

3.5 FIELD QUALITY CONTROL

A. Remove and replace work where test results indicate that it does not comply with specified requirements.

B. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.6 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

3.7 TOLERANCES

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

B. Maximum Variation of any Member from Plane: 1/16".

END OF SECTION 05400

SECTION 05450 - LIGHT GAGE STEEL TRUSSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work specified in this section.

1.2 SUMMARY

A. The extent of light gage steel trusses is shown on the drawings, including notes, elevations and details to show basic layout and location of members, typical connections, and type of steel required.

B. Types of light gage steel trusses include:
   1. Gable-shaped trusses

C. Section includes all work and supplementary items required to complete the proper installation of the pre-engineered light gage roof trusses as shown on the drawings and specified herein including headers, outriggers, supplemental rafters and incidental framing for a complete roof assembly within the extent shown on the drawings.

D. Pre-engineered light gage steel trusses include planar structural units consisting of welded, screwed or bolted connected members which are fabricated, cut and assembled prior to delivery or at the job site.

E. Miscellaneous Metal Fabrications shown on the drawings are specified elsewhere in Division5.

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
   1. Submit all shop drawings on three prints. One print will be returned. All additional prints required by the Contractor are the responsibility of the Contractor and shall be made after the reviewed shop drawings are returned.

B. Product Data: Submit fabricator's technical data covering materials, shapes, hardware, fabrication process, handling and erection.

C. Shop Drawings: Submit shop drawings showing shapes and dimensions of members to be used including pitch, span, camber configuration and spacing for each type or configuration of truss required. Show all bearing and anchorage details. Specify and detail all supplemental strapping, bracing clips and other accessories required for proper installation and permanent member bracing. Shop drawings shall include all placement sequences and instructions.

1. Submit design analysis and test reports indicating loading, section properties, allowable stress, stress diagrams and calculations, and similar information needed for analysis and to insure trusses comply with requirements.
2. All shop drawings and calculations shall bear the name and seal of a Structural Engineer licensed to practice in the State of Alabama. Submittals which do not contain this information will be returned unchecked.

D. Quality Control Program: Submit written and bound quality control program which includes procedures for product certification and truss engineering, fabrication, handling, delivery, temporary storage, and erection procedures.

1. Quality Control Manual will be used as basis for inspection by a testing agency engaged by the Owner to determine compliance with the Quality Control Manual and other tests and observations noted herein.

E. Architect's Shop Drawing Review: Review of shop drawings will be for general considerations only. Compliance with requirements for materials, fabrication, and erection of structural steel is the Contractor's responsibility. Submit all shop drawings on one reproducible copy and two blueline prints only. Only the reproducible will be returned. Additional bluelines required by the Contractor are the Contractor's responsibility and shall be made after reproducible is returned. If additional bluelines are submitted, they will be returned unmarked.

1.4 QUALITY ASSURANCE

A. Codes and Standards: Comply with provisions of the following, except as otherwise indicated.

1. AWS D1.3 "Structural Welding Code for Sheet Steel".
2. AISI "Specification for the Design of Cold-Formed Steel Structural Members."
3. ASTM A653 "Specification for Sheet Steel, Zinc Coated (Galvanized) by the Hot-Dip Process, Physical (Structural) Quality".

B. Qualifications for Welding Work:

1. Qualify welding processes and welding operations in accordance with AWS D1.3 “Structural Welding Code for Sheet Steel”.
2. Provide certification that welders to be employed in the work have satisfactorily passed AWS qualification tests within the previous 12 months.
    a. If recertification of welders is required, retesting will be the Contractor’s responsibility.

C. Design of Members and Connections:

1. All details shown are typical; similar details apply to similar conditions, unless otherwise indicated. Verify dimensions at the site whenever possible without causing delay in the work.
2. Promptly notify the Architect whenever design of members and connections for any portion of the structure are not clearly indicated.

1.5 FABRICATOR'S QUALIFICATIONS

A. Trusses shall be designed, fabricated, and erected by a firm which has a record including a minimum of five years of successfully designing, fabricating, and erecting trussed assemblies similar to scope required and which practices a quality control program.

B. Fabricators who wish to qualify for approval under this Section of the specification shall submit evidence of compliance with this specification no later than ten (10) days prior to the bid date. Only those fabricators approved in writing by the Architect or Construction Manager prior to the bid date will be accepted.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the site at such intervals to insure uninterrupted progress of the work.

B. Store materials to permit easy access for inspection and identification. Keep steel members off the ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from corrosion and deterioration.

1. Do not store materials on structure in a manner that might cause distortion or damage to supporting structures.

C. Deliver and handle products in exact accordance with the manufacturer's latest published requirements and specifications to avoid damage from bending, overturning, or other cause for which truss is not designed to resist or endure.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Sheet Steel: ASTM A653 "Specification for Sheet Steel, Zinc Coated Galvanized) by the Hot-Dip Process, Physical (Structural) Quality".

1. Grade A, Fy = 33ksi; 18 gage and lighter
2. Grade D, Fy = 50 ksi; 16 gage and heavier
3. Galvanizing: G-60 Coating Class

B. Galvanizing: ASTM A525

C. Fasteners: ITW Buildex pan head screws and bolts or others submitted and approved by the Architect.

D. Electrodes for Welding: Comply with AWS Code

E. Paint: Zinc Chromate, Oil-alkyd; TT-P-57, Type I.

2.2 DESIGN

A. All calculations and procedures pertaining to design, analysis, and computation of section properties shall be in accordance with the Specification for the Design of Cold-Formed Steel Structural Members of the American Iron and Steel Institute.

B. Design trusses for loads indicated on drawings plus concentrated loads hung from or supported on trusses. Refer to mechanical, electrical and plumbing drawings and specifications for loading information and location. Loading as required by other subcontractors, such as fire protection, shall be coordinated by the General Contractor.

C. Holes in Members: Design for holes in members where shown for securing other work to trusses; however, deduct area of holes from the area of chord when calculating strength of member.

D. Design bridging and other temporary and permanent bracing for same loads as used to design trusses plus any temporary loads and permanent loads resulting laterally bracing of members.

2.3 FABRICATION

A. Light gage steel trusses to be fabricated at the fabricator's shop.

B. All trusses shall be fabricated and erected in strict accordance with the current printed instructions of the approved subcontractor or fabricator.

C. All truss components shall be straight and true prior to fabrication. Flattening or straightening of components, when necessary, shall be accomplished in a manner so as to not damage the component.

D. All truss components shall be cut neatly to fit snugly against adjacent members.

E. No splices will be allowed in trusses except as authorized in writing by the Architect or as shown on the approved shop drawings.

F. Framing components shall be field or shop fabricated and joined to one another by means of welding or through the use of screws.

G. Completed trusses shall be free from twists, bends, or open joints with all members straight and true to line.

H. Welds must be thoroughly cleaned and wire brushed and primed and painted with a high zinc content paint capable of providing an equal or greater degree of protection than the original G-60 galvanized coating.

I. Bridging: Fabricate horizontal or diagonal type bridging for trusses as required to prevent buckling of members where sheathing applied to the truss members is not present or is not adequate to brace the truss member. Bridging shall transfer all forces to the roof diaphragm.

J. End Anchorage: Fabricate end anchorages to secure trusses to adjacent construction.

K. Fabricate all clips, angles, henways and other miscellaneous pieces necessary to attach light gage steel trusses to the substructure or to attach other components within this section to one another.

PART 3 - EXECUTION

3.1 INSPECTION

A. Erector must examine areas and conditions under which the trusses are to be installed, and notify Contractor and Architect in writing of conditions detrimental to proper and timely completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to the Erector. Additionally, the following items shall be installed and inspected prior to roof truss installation.

1. Conditions of Surfaces:
   a. Exterior and Interior Bearing Plates:
      1) Properly positioned.
      2) Installed so as to allow complete and adequate contact with truss connection member.
   b. Exterior and Interior Bearing Plates installed in proper elevations so as to permit the installation of the truss system without the use of shims oradjustability.

3.2 PREPARATION

A. Structural Adequacy: Contractor shall prepare the structure to insure proper and adequate structural support for the materials specified.

3.3 ERECTION

A. Prefabricated trusses shall be braced against racking. Lifting of trusses shall be done so as to not cause local distortion in anymember.

B. All light gage steel framing shall be erected using equipment of adequate capacity to safely perform the work.

C. The General Contractor is responsible for checking the dimensions and assuring the fit of all members and trusses before erection begins.

1. All work shall be erected plumb and level and to dimensions and spacings indicated on the drawings. Provide bridging as shown in the shop drawings.

D. Assemblies shall be of the size and spacing shown on the approved shop drawings.

E. Provide web stiffeners and reinforcement at reaction points where required by analysis or to suit details.

F. Hoist units in place by means of lifting equipment suited to sizes and types of trusses required, applied at designated lift points as recommended by fabricator, exercising care not to damage truss members.

G. Provide temporary bracing as required to maintain trusses plumb, parallel and in location indicated, until permanent bracing is installed.

H. Anchor trusses securely at all bearing points to comply with methods and details indicated.

I. Install permanent bracing and related components to enable trusses to maintain design spacing, With-stand design loads, and comply with other indicated requirements.

J. Do not cut or remove truss members.

K. Temporary Planking: Provide temporary planking and working platforms as necessary to effectively complete work.

L. Field Assembly: Set structural frames accurately to lines and elevations indicated. Align and adjust various members forming part of complete frame or structure before permanently fastening.

3.4 QUALITY CONTROL

A. The Owner will engage an independent testing agency to perform shop and field inspection of trusses during fabrication.

B. Testing Agency shall conduct and interpret tests and state in each report whether observations and tests comply with the requirements and specifically state any deviations therefrom.

C. Provide Access for testing agency to places where truss work is being fabricated or produced so that required inspections, observations and testing can be accomplished.

D. Architect reserves the right, at any time before final acceptance, to reject material not complying with specified requirements regardless of when testing agency completed inspection, observation or testing.

E. Correct deficiencies in truss work which inspections and test reports have indicated to be not in compliance with requirements. Perform additional tests, at Contractor’s expense, as may be necessary to reconfirm any non-compliance of original work, and as may be necessary to show compliance of correct work.

F. Confirmation of Quality Control Manual: The testing agency will make a minimum of five site visits to the fabricators shop and/or to the jobsite to confirm conformance with the Quality Control Manual submitted to and accepted by the Architect. Provide minimum of three of the five visits to the jobsite.

G. Prior to Truss Erection: The testing agency will inspect all trusses as follows either at the shop of in the field.

1. The testing Agency will visually inspect all trusses and certify them as meeting the requirements of the approved shop drawings and these specifications.
2. Inspection shall include welds. Visually inspect all welds according to AWS Welding Code.

H. After Truss Erection: The testing agency will inspect all trusses after erection and temporary and permanent bracing is in place as follows.

1. The testing Agency shall inspect the installed trusses to certify that installation is in accordance with approved shop drawings and these specifications.

I. Testing Agency shall submit written reports to Architect within 3 days of the inspections. Under no circumstances are trusses to be erected prior to testing agency approval.

END OF SECTION 05450

SECTION 05500 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. This Sections includes:
1. Steel framing and supports for countertops.
2. Steel framing and supports for mechanical and electrical equipment.
3. Steel framing and supports for applications where framing and supports are not specified in other Sections.
4. Steel fencing, gates and accessories.
5. Elevator machine beams and hoist beams.
6. Support angles for elevator door sills.
7. Shelf angles.
8. Loose bearing and leveling plates.
9. Steel weld plates and angles for casting into concrete not specified in other Sections.
10. Metal ladders.
11. Metal bollards.
12. Abrasive metal nosings.
13. Metal downspout boots.
14. Roof fall protection anchors.

B. Products furnished, but not installed, under this Section include the following:
1. Loose steel lintels.
2. Anchor bolts, steel pipe sleeves, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.

1.2 RELATED REQUIREMENTS

A. Section 03300 - Cast-in-Place Concrete: Placement of metal fabrications in concrete.

B. Section 04810 - Unit Masonry Assemblies: Placement of metal fabrications in masonry.

C. Section 05510 - Metal Stairs.

D. Section 05520 - Handrails and Railings.

E. Section 09900 - Paints and Coatings: Paint finish.

1.3 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2008.

B. ASTM A 53/A 53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2007.

C. ASTM A 283/A 283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2003 (Reapproved 2007).

D. ASTM A 500/A 500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2010.

E. ASTM B26/B26M - Standard Specification for Aluminum-Alloy Sand Castings; 2009.

F. ASTM B 85 - Standard Specification for Aluminum-Alloy Die Castings; 2009.

G. ASTM B 209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2007.

H. ASTM B 209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric]; 2007.

I. ASTM B 210 - Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes; 2004.

J. ASTM B 210M - Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes (Metric); 2005.

K. ASTM B 211 - Standard Specification for Aluminum and Aluminum-Alloy Bar, Rod, and Wire; 2003.

L. ASTM B 211M - Standard Specification for Aluminum and Aluminum-Alloy Bar, Rod, and Wire (Metric); 2003.

M. ASTM B 221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2008.

N. ASTM B 221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric]; 2007.

O. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; American Welding Society; 2007.

P. AWS D1.1/D1.1M - Structural Welding Code - Steel; American Welding Society; 2010.

Q. AWS D1.2/D1.2M - Structural Welding Code - Aluminum; American Welding Society; 2003, and Errata 2004.

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

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

T. SSPC-SP 2 - Hand Tool Cleaning; Society for Protective Coatings; 1982 (Ed. 2004).

1.4 PERFORMANCE REQUIREMENTS

A. Structural Performance of Ladders: Provide ladders capable of withstanding the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.

B. Thermal Movements: Provide exterior metal fabrications that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

C. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

1.5 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: For the following:
   1. Nonslip aggregates and nonslip-aggregate surface finishes.
   2. Metal nosings.
   3. Paint products.
   4. Grout.

C. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
   1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

D. Samples for Verification: For each type and finish of extruded nosing.

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

1.6 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to the following:
   1. AWS D1.1, "Structural Welding Code--Steel."
   2. AWS D1.3, "Structural Welding Code--Sheet Steel."

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
2. Provide allowance for trimming and fitting at site.

1.8 COORDINATION

A. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

B. Coordinate installation of steel weld plates and angles for casting into concrete that are specified in this Section but required for work of another Section. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.2 MATERIALS - STEEL

A. Steel Sections: ASTM A 36/A 36M.

B. Steel Tubing: ASTM A 500, Grade B cold-formed structural tubing.

C. Plates: ASTM A 283.

D. Pipe: ASTM A 53/A 53M, Grade B Schedule 40, black finish.

E. Cast Iron: ASTM A 48/A 48M, Class 30, unless another class is indicated or required by structural loads.

F. Slotted Channel Framing: ASTM A 653, Grade 33.

G. Slotted Channel Fittings: ASTM A1011/A1011M.

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

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

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

2.3 MATERIALS - ALUMINUM

A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.

B. Sheet Aluminum: ASTM B209 (ASTM B209M), 5052 alloy, H32 or H22 temper.

C. Aluminum-Alloy Drawn Seamless Tubes: ASTM B210 (ASTM B210M), 6063 alloy, T6 temper.

D. Aluminum-Alloy Bars: ASTM B211 (ASTM B211M), 6061 alloy, T6 temper.

E. Aluminum-Alloy Sand Castings: ASTM B26.

F. Aluminum-Alloy Die Castings: ASTM B85.

G. Welding Materials: AWS D1.2/D1.2M; type required for materials being welded.

2.4 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at exterior walls. Provide stainless-steel fasteners for fastening aluminum. Select fasteners for type, grade, and class required.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.

C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, nuts and, where indicated, flat washers; ASTM F 593 for bolts and ASTM F 594 for nuts, Alloy Group 1.

D. Anchor Bolts: ASTM F 1554, Grade 36.
   1. Provide hot-dip or mechanically deposited, zinc-coated anchor bolts where item being fastened is indicated to be galvanized.

E. Machine Screws: ASME B18.6.3.

F. Lag Bolts: ASME B18.2.1.

G. Wood Screws: Flat head, ASME B18.6.1.

H. Plain Washers: Round, ASME B18.22.1.

I. Lock Washers: Helical, spring type, ASME B18.21.1.

J. Cast-in-Place Anchors in Concrete: Anchors capable of sustaining, without failure, a load equal to four times the load imposed, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

1. Threaded or wedge type; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A 153/A 153M.

K. Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

1. Material for Anchors in Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.
2. Material for Anchors in Exterior Locations: Alloy Group 1 stainless-steel bolts complying with ASTM F 593 and nuts complying with ASTM F 594.

2.5 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Zinc-Rich Primer: Complying with SSPC-Paint 20 or SSPC-Paint 29 and compatible with topcoat.

1. Use primer with a VOC content of 3.5 lb/gal. or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Available Products:
   a. Benjamin Moore & Co.; Epoxy Zinc-Rich Primer CM18/19.
   b. ICI Devoe Coatings; Catha-Coat 313.
   c. PPG Architectural Finishes, Inc.; Aquapon Zinc-Rich Primer 97-670.
   d. Sherwin-Williams Company (The); Corothane I GalvaPac Zinc Primer.

C. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

E. Nonshrink, Metallic Grout: Factory-packaged, ferrous-aggregate grout complying with ASTM C 1107, specifically recommended by manufacturer for heavy-duty loading applications.

F. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

G. Concrete Materials and Properties: Comply with requirements in Division 3 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi, unless otherwise indicated.

2.6 FABRICATION

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

B. Fabricate items with joints tightly fitted and secured.

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

D. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

E. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

F. Form exposed work true to line and level with accurate angles and surfaces and straight edges.

G. Weld corners and seams continuously to comply with the following:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

H. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts, unless otherwise indicated. Locate joints where least conspicuous.

I. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

J. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

K. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

L. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2- inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.7 FABRICATED ITEMS

A. Metal Fencing and Gates:

1. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For metal fencing exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
2. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
3. Steel Tubing: ASTM A 500, cold-formed steel tubing.
4. Anchor Bolts: ASTM F 1554, Grade 36.
5. Epoxy Anchors: Anchor bolts with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
    a. Provide anchors equal to Hilti HY 150 adhesive anchors with 3-3/4" embedment into the concrete.
6. Caps: Cast steel galvanized; sized to post dimensions.
7. Fittings: Sleeves, clips, fasteners and fittings; steel.
8. Hardware for Single Swinging Gates: 180 degree hinges, 2 for gates up to 60 inches high, 3 for taller gates; fork latch with gravity drop and padlock hasp; keeper to hold gate in fully open position.
9. Hardware for Double Swinging Gates: 180 degree hinges, 2 for gates up to 60 inches high, 3 for taller gates; drop bolt on inactive leaf engaging socket stop set in concrete, active leaf latched to inactive leaf preventing raising of drop bolt, padlock hasp; keepers to hold gate in fully open position.
10. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.
11. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
    a. Sandblast steel surfaces before applying primer.
12. Finish: Powder-coated as follows:
    a. Comply with AAMA 2605 for high-performance exterior applications. Provide 2605 powder coat utilizing a fluoropolymer resin (PVDF).
    b. Dry film thickness: 1.2 mils minimum.

B. Sill Angles for Tempered Glass Railing Assemblies: ASTM A 36/A 36M steel angles with anchoring devices and sizes as indicated in shop drawings for railing assembly, drilled and tapped for fastener types, sizes, and spacing indicated, prime paint finish.

C. Elevator Hoistway Divider Beams: Beam sections; prime paint finish.

2.8 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.

1. Furnish inserts if units are installed after concrete is placed.

C. Fabricate supports for operable partitions and trolley-hoist rail system from continuous steel beams of sizes indicated with attached bearing plates, anchors, and braces as indicated. Drill bottom flanges of beams to receive partition track and rail system hanger rods; locate holes where indicated on operable partition and rail system Shop Drawings.

D. Fabricate steel girders for wood frame construction from continuous steel shapes of sizes indicated.

1. Provide bearing plates welded to beams where indicated.
2. Drill girders and plates for field-bolted connections where indicated.
3. Where wood nailers are attached to girders with bolts or lag screws, drill holes at 24 inches o.c.

E. Galvanize all miscellaneous framing and supports in exterior locations and in exterior walls.

F. Prime miscellaneous all interior framing and supports.

2.9 LOOSE STEEL LINTELS

A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Weld adjoining members together to form a single unit where indicated.

B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span but not less than 8 inches, unless otherwise indicated.

C. Galvanize loose steel lintels located in exterior walls.

D. Prime loose steel lintels located in interior walls with zinc-rich primer.

2.10 SHELF ANGLES

A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches o.c., unless otherwise indicated.

1. Provide mitered and welded units at corners.
2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches larger than expansion or control joint.

B. Galvanize shelf angles located in exterior walls.

C. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.11 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

B. Galvanize plates after fabrication.

2.12 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with not less than two integrally welded steel strap anchors for embedding in concrete.

2.13 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.

1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

C. Galvanize all exterior miscellaneous steel trim.

D. Prime all interior miscellaneous steel trim with zinc-rich primer.

2.14 METAL LADDERS

A. General:
1. Comply with ANSI A14.3, unless otherwise indicated.
2. For elevator pit ladders, comply with ASME A17.1.
3. Space siderails 18 inches apart.
4. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted brackets, made from same metal as ladder.

B. Steel Ladders:
1. Siderails: Continuous, 3/8-by-2-1/2-inch steel flat bars, with eased edges.
2. Rungs: 3/4-inch- diameter steel bars.
3. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
4. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.
5. Prime interior ladders including brackets and fasteners, with zinc-rich primer.

2.15 METAL BOLLARDS

A. Fabricate round metal bollards from Schedule 40 steel pipe.

B. Fabricate square metal bollards from steel tubing.
1. Cap bollards with 1/4-inch- thick steel plate.
2. Where bollards are indicated to receive push-button controls for door operators and card access, provide necessary cutouts for controls and hole with cover plate for connecting wiring.

C. Fabricate square tube steel bollard with 3/8-inch- thick steel baseplates for bolting to concrete slab. Drill baseplates at all 4 corners for 3/4-inch anchor bolts.

D. Fabricate sleeves for removable bollards from schedule 40 steel pipe.

2.16 ABRASIVE METAL NOSINGS

A. Cast-Metal Units for Concrete Stairs: Cast gray iron, Class 20, with an integral abrasive finish consisting of aluminum oxide, silicon carbide, or a combination of both. Fabricate units in sizes and configurations indicated and in lengths necessary to accurately fit openings or conditions.
1. Available Manufacturers:
   a. American Safety Tread Co., Inc.
   b. Balco Inc.
   c. Barry Pattern & Foundry Co., Inc.
   d. Granite State Casting Co.
   e. Safe-T-Metal Co.
   f. Wooster Products Inc.
2. Nosings: Cross-hatched units, 4 inches wide equal to American Safety Tread #801 for casting into concrete steps.

B. Extruded Units for Wood Stairs: Aluminum, with abrasive filler consisting of aluminum oxide, silicon carbide, or a combination of both, in an epoxy-resin binder. Fabricate units in sizes and configurations indicated and in lengths necessary to accurately fit openings or conditions.

1. Available Manufacturers:
   a. ACL Industries, Inc.
   b. American Safety Tread Co., Inc.
   c. Amstep Products.
   d. Armstrong Products, Inc.
   e. Balco Inc.
   f. Granite State Casting Co.
   g. Wooster Products Inc.
2. Provide ribbed units, with abrasive filler strips projecting 1/16 inch above aluminum extrusion.
3. Nosings: Square-back units, 1-3/8 inches wide, for installing into wood steps. Provide units designed to finish flush with applied tread finish where scheduled on the Drawings.

C. Provide anchors for embedding units in wood, applied to units with recessed screws, as standard with manufacturer.

D. Apply bituminous paint to concealed bottoms, sides, and edges of cast-metal units set into concrete.

2.17 METAL DOWNSPOUT BOOTS

A. Provide downspout boots made from cast gray iron in heights indicated with inlets of size and shape to suit downspouts.

B. Exceptions: Do not prime surfaces in direct contact with concrete, where field welding is required, and items to be covered with sprayed fireproofing.

C. Outlet: Vertical, to discharge into storm drainage pipe.

D. Prepare surfaces to be primed in accordance with SSPC-SP2.

E. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

2.18 ROOF FALL PROTECTION ANCHORS

A. Anchors: Provide single-point anchor devices designed for connection of safety cables or ropes. Anchors shall consists of steel tube post, base plate, and swivel-type top connector piece. Anchors shall have the following characteristics:

1. Capacity: 5,000 lbs in any direction.
2. Height" 1'-6".

3. Post diameter: 4-1/2".
4. Locations: Locate where indicated on Drawings, but no less than one (1) every 40 feet along roof ridge.
5. Basis of Design: Single Point Anchor (SPA) as manufactured by Diversified Fall Protection, Inc., tel.. 877-256-2870.

2.19 FINISHES, GENERAL

A. Prime Painting: One coat.

B. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

C. Finish metal fabrications after assembly.

2.20 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:
1. ASTM A 123/A 123M, for galvanizing steel and iron products.
2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.

B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:
1. Exteriors (SSPC Zone 1B) and Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."

C. Shop Priming: Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete or masonry, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2.21 FINISHES - ALUMINUM

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

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

3.3 INSTALLATION, GENERAL

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

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

C. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

D. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

E. Field Welding: Comply with the following requirements:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag bolts, wood screws, and other connectors.

G. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

H. Corrosion Protection: 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.

3.4 INSTALLING FENCING FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including requirements indicated on Shop Drawings.

B. Fasten steel framing to concrete with 3/4" diameter adhesive anchors.

3.5 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

B. Anchor supports for operable partitions and trolley railing system securely to and rigidly brace from building structure.

3.6 INSTALLING BEARING AND LEVELING PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.

1. Use nonshrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations, unless otherwise indicated.
2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.7 INSTALLING PIPE BOLLARDS

A. Anchor removable bollards in concrete with pipe sleeves preset and anchored into concrete. Bottom of sleeve shall be open-end with gravel for drainage.

B. Anchor fixed steel bollards in place with concrete footings. Center and align bollards in holes 3 inches above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured. Slope concrete at base of bollard at ¼-inch per foot to shed water.

1. Fill bollards solidly with concrete, mounding top surface to shed water. Mounded portion of concrete shall a maximum of 1-inch above edge of pipe, have a uniformly radius, and a smooth trowel finish.

3.8 INSTALLING NOSINGS, TREADS, AND THRESHOLDS

A. Center nosings on tread widths.

B. For nosings embedded in concrete steps, align nosings flush with riser faces and level with tread surfaces except where treads are scheduled to receive applied finish.

C. For nosings embedded in wood steps, align nosings as detailed on the Drawings.

3.9 INSTALLING ROOF FALL PROTECTION ANCHORS

A. Install roof anchors in strict accordance with manufacturers written instructions.

B. Install minimum four (4) bolts through base plates and securely fasten to roof structure below roofing surface.

C. Coordinate with roofing material to provide a watertight finished installation.

3.10 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 9 painting Sections.

C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 05500

SECTION 05510 - METAL STAIRS AND RAILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, General Conditions and Division-1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Steel-framed stairs.
2. Steel pipe handrails and railing systems attached to metal stairs.
3. Steel pipe handrails attached to walls/guardrails adjacent to metal stairs.
4. Steel tube guardrails with metal infill panels.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Engineer, fabricate, and install steel stairs to withstand the following structural loads without exceeding the allowable design working stress of the materials involved, including anchors and connections. Apply each load to produce the maximum stress in each component of steel stairs.

1. Treads of Steel Stairs: Capable of withstanding a uniform load of 100 lbf per sq. ft. or a concentrated load of 300 lbf on a area of 4 sq. inches located in the center of the tread, whichever produces the greater stress.
2. Platforms of Steel Stairs: Capable of withstanding a uniform load of 100 lbf/sq. ft.
3. Stair Framing: Capable of withstanding stresses resulting from loads specified above as well as stresses resulting from railing system loads.

B. Structural Performance of Handrails and Railing Systems: Engineer, fabricate, and install handrails and railing systems to comply with requirements of ASTM E 985 for structural performance based on the following:

1. Testing performed according to ASTM E 894 and E 935.
2. Structural computations.

C. Structural Performance: Engineer, fabricate, and install handrails and railing systems to withstand the following structural loads without exceeding the allowable design working stress of the materials involved, including anchors and connections. Apply each load to produce the maximum stress in each of the respective components of each metal fabrication.

1. Top Rail of Guardrail Systems: Capable of withstanding the following loads applied as indicated:
   a. Concentrated load of 200 lbf applied at any point and in any direction.
   b. Uniform load of 50 lbf per linear foot applied horizontally and concurrently with uniform load of 100 lbf per linear foot applied vertically downward.
   c. Concentrated and uniform loads above need not be assumed to act concurrently.

2. Handrails Not Serving as Top Rails: Capable of withstanding the following loads applied as indicated:
   a. Concentrated load of 200 lbf applied at any point and in any direction.
   b. Uniform load of 50 lbf per linear foot applied in any direction.
   c. Concentrated and uniform loads above need not be assumed to act concurrently.
3. Infill Area of Guardrail Systems: Capable of withstanding a horizontal concentrated load of 200 lbf applied to one sq. ft. at any point in the system including panels, intermediate rails, balusters, or other elements composing the infill area.
   a. Above load need not be assumed to act concurrently with loads on top rails of railing systems in determining stress on guard.

1.4 SUBMITTALS

A. Submit each item according to General Conditions and Division 1 Specification Sections.

B. Product data for metal stairs, expanded metal stair treads and floor plate, paint products, and grout.

C. Shop drawings detailing fabrication and installation of steel stairs. Include plans, elevations, sections, and details of steel stairs and their connections. Show anchorage and accessory items. Provide templates for anchors and bolts specified for installation under other sections.
   1. For installed steel stairs indicated to comply with certain design loadings, include structural analysis data sealed and signed by a licensed professional structural engineer who was responsible for their preparation.

D. Samples for verification of the following products, in the form of sections of units in manufacturer's standard sizes. Prepare 6" long samples from same material to be used for the Work.

E. Welder certificates signed by Contractor certifying that welders comply with requirements specified under the "Quality Assurance" Article.

F. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include list of completed projects with project names, addresses, names of architects and owners, and other information specified.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Firm experienced in producing steel stairs similar to those indicated for this Project with a record of successful in-service performance and with sufficient production capacity to produce required units without delaying the Work.

B. Installer Qualifications: Arrange for steel stair installation specified in this Section by the same firm that fabricated them.

C. Engineer Qualifications: A professional structural engineer legally authorized to practice in jurisdiction where Project is located and experienced in providing engineering services of the kind indicated that have resulted in the installation of metal stairs (including handrails and railing systems) similar to this Project in material, design, and extent and that have a record of successful in-service performance.

D. Welding Standards: Comply with applicable provisions of AWS D1.1 "Structural Welding Code--Steel" and AWS D1.3 "Structural Welding Code--Sheet Steel."

1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

PART 2 - PRODUCTS

2.1 FERROUS METALS

A. Metal Surfaces: For surfaces exposed to view in the completed Work, provide materials selected for their surface flatness, smoothness, and freedom from surface blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, roughness, or, for steel sheet, variations in flatness exceeding those permitted by referenced standards for stretcher-leveled sheet.

B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

C. Steel Tubing: Product type (manufacturing method) and as follows:

1. Cold-Formed Steel Tubing: ASTM A 500.
2. Hot-Formed Steel Tubing: ASTM A 501.

D. Steel Pipe: ASTM A 53, standard weight (schedule 40), unless otherwise indicated, or another weight required by structural loads.

1. Black finish.

E. Metal Infill Panels: Use woven wire fabric equal to "Architectural Wire Mesh" by McNichols Co. Fabric shall be fabricated with .192" diameter steel wire and 2" x 4" openings. Provide 1" x 2" x 1/8" steel tube frame surrounding mesh on all sides. Secure mesh to tube frame by welding to a steel U-channel, or back-to-back steel angles, sized to suit mesh and tube.

F. Uncoated Structural Steel Sheet: Product type (manufacturing method), quality, and grade as follows:

1. Cold-Rolled Structural Steel Sheet: ASTM A 611, grade as follows:
Grade A, unless otherwise indicated or required by design loading.
2. Hot-Rolled Structural Steel Sheet: ASTM A 570/A 570M, grade as follows:
    a. Grade 30, unless otherwise indicated or required by design loading.

G. Uncoated Steel Sheet: Commercial quality, product type (method of manufacture) as follows:
1. Cold-Rolled Steel Sheet: ASTM A 366/A 366M.
2. Hot-Rolled Steel Sheet: ASTM A 569/A 569M.

H. Welding Rods and Bare Electrodes: Select according to AWS specifications for the metal alloy to be welded.

2.2 FASTENERS

A. Provide plated fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating, for exterior use or where built into exterior walls. Select fasteners for the type, grade, and class required.

B. Bolts and Nuts: Regular hexagon-head type, ASTM A 307, Grade A (ASTM F 568, Property Class 4.6), with hex nuts, ASTM A 563 (ASTM A 563M), and, where indicated, flat washers.

C. Machine Screws: ANSI B18.6.3 (ANSI B18.6.7M).

D. Lag Bolts: ANSI B18.2.1 (ANSI B18.2.3.8M).

E. Plain Washers: Round, carbon steel, ANSI B18.22.1 (ANSI B18.22M).

F. Lock Washers: Helical, spring type, carbon steel, ANSI B 18.21.1.

G. Expansion Anchors: Anchor bolt and sleeve assemblies of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.
1. Material: Carbon steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.

2.3 PAINT

A. Shop Primer for Ferrous Metal: Fast-curing, lead and chromate-free, universal modified- alkyd primer complying with performance requirements of FS TT-P-664, selected for good resistance to normal atmospheric corrosion, compatibility with finish paint systems indicated, and capability to provide a sound foundation for field-applied topcoats despite prolonged exposure. Color - light gray.

B. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12, except containing no asbestos fibers.

2.4 GROUT

A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

B. Products: Subject to compliance with requirements, provide one of the following:
1. Nonshrink, Nonmetallic Grouts:
a. "B-6 Construction Grout;" W. R. Bonsal Co.
b. "Euco N-S Grout;" Euclid Chemical Co.
c. "Crystex;" L&M Construction Chemicals, Inc.
d. "Masterflow 928 and 713;" Master Builders Technologies, Inc.
e. "Sealtight 588 Grout;" W. R. Meadows, Inc.
f. "Sonogrout 14"; Sonneborn Building Products--ChemRex, Inc.

2.5 FABRICATION

A. Form steel stairs from materials of size, thickness, and shapes indicated, but not less than that needed to comply with performance requirements indicated. Work to dimensions indicated or accepted on shop drawings, using proven details of fabrication and support.

B. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.

C. Shear and punch metals cleanly and accurately.

D. Remove sharp or rough areas on exposed surfaces.

E. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

F. Weld corners and seams continuously to comply with the following:
1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing, and welded surface matches contours of adjoining surfaces.

G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat- head (countersunk) screws or bolts. Locate joints where least conspicuous.

H. Weld wire mesh infill to steel bar frame at each point where wire mesh touches frame. Align each connection point to be straight and without any gaps.

I. Shop Assembly: Preassemble in shop to greatest extent possible to minimize field splicing and assembly. Use connections that maintain structural value of joined pieces. Clearly mark units for field assembly and coordinated installation.

2.6 STEEL-FRAMED STAIRS

A. Construct stairs to conform to sizes and arrangements indicated. Join pieces together by welding, unless otherwise indicated. Provide complete stair assemblies, including metal framing, hangers, columns, handrails, railing systems, newels, balusters, struts, clips, brackets, bearing plates, or other components necessary for the support of stairs and platforms, and as required to anchor and contain the stairs on the supporting structure.

1. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM "Metal Stair Manual" for class of stair designated, except where more stringent requirements are indicated.
    a. Commercial class.

B. Stair Framing: Fabricate stringers of structural steel channels, plates, or a combination thereof, as indicated. Provide closures for exposed ends of stringers. Construct platforms of structural steel channel headers and miscellaneous framing members as indicated. Bolt or weld headers to stringers; and bolt or weld newels and framing members to stringers and headers. If using bolts, fabricate and join so bolts are not exposed on finish surfaces.

C. Metal treads and platforms: Shape metal treads to conform to configuration shown. Provide thicknesses of structural steel for metal indicated, but not less than that required, to support total design loading.

1. Attach treads to stringers with brackets made of steel angles or bars. Weld brackets to stringers and attach metal to brackets by welding, riveting, or bolting.
2. Provide platforms of configuration and construction indicated; of same metal as treads, in thicknesses required to support design loading. Attach platform to platform framing members with welds.

2.7 STEEL PIPE HANDRAILS AND RAILING SYSTEMS

A. Fabricate pipe handrails and railing systems to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of pipe, post spacings, and anchorage, but not less than that required to support structural loads.

B. Interconnect railing and handrail members by butt-welding or welding with internal connectors, at fabricator's option, unless otherwise indicated.

1. At tee and cross intersections, cope ends of intersecting members to fit contour of pipe to which end is joined, and weld all around.

C. Form changes in direction of handrails and rails as follows:

1. By welding in prefabricated flush elbow fittings.
2. By flush radius bends.
3. By bending.

D. Form simple and compound curves by bending pipe in jigs to produce uniform curvature for each repetitive configuration required; maintain cylindrical cross section of pipe throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of pipe.

E. Provide wall returns at ends of wall-mounted handrails.

F. Close exposed ends of pipe by welding 3/16 inch thick steel plate in place or with prefabricated fittings, except where clearance of end of pipe and adjoining wall surface is ¼ inch or less.

G. Fabricate newels of steel tubing and provide newel caps as shown.

H. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnections of pipe and attachment of handrails and railing systems to other work. Furnish inserts and other anchorage devices for connecting handrails and railing systems to concrete or masonry work.

1. Connect railing posts to stair framing by direct welding, unless otherwise indicated.

I. Fillers: Provide steel sheet or plate fillers of thickness and size indicated or required to support structural loads of handrails where needed to transfer wall bracket loads through wall finishes to structural supports. Size fillers to suit wall finish thicknesses. Size fillers to produce adequate bearing to prevent bracket rotation and overstressing of substrate.

J. Provide non-galvanized ferrous metal fittings, brackets, fasteners, and sleeves.

2.8 FINISHES

A. Finish metal stairs after assembly.

B. Metal Jointing and Finish Quality Levels:

1. Architectural: All joints as inconspicuous as possible, whether welded or mechanical.
   a. Welded Joints: Continuously welded and ground smooth and flush.
   b. Mechanical Joints: Butted tight, flush, and hairline; concealed fastenings only.
   c. Exposed Edges and Corners: Eased to small uniform radius.
   d. Metal Surfaces to be Painted: Sanded or ground smooth, suitable for highest quality gloss finish.

C. Preparation for Shop Priming: Prepare uncoated ferrous metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed units:

1. Interiors (SSPC Zone 1A): SSPC SP 3 "Power Tool Cleaning."
2. Exteriors: All exterior stairs and railings shall be shop primed with an epoxy primer compatible with the finish paint required as specified in Section 09900 - Painting.

D. Apply shop primer to uncoated surfaces, except those with galvanized finish or those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with requirements of SSPC-PA 1 "Paint Application Specification No. 1" for shop painting.

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installing anchorages, including concrete inserts, weld plates, and anchor bolts. Coordinate delivery of such items to Project site.

3.2 INSTALLATION, GENERAL

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing steel stairs to in-place construction; include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors as required.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing steel stairs. Set units accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

C. Install steel stairs by welding stair framing to steel structure or to weld plates cast into concrete, except where otherwise indicated.

D. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop-welded because of shipping size limitations. Do not weld, cut, or abrade the surfaces of exterior units that have been hot-dip galvanized after fabrication and are intended for bolted field connections.

E. Field Welding: Comply with the following requirements:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and welded surface matches contours of adjoining surfaces.

3.3 INSTALLING STEEL STAIRS WITH GROUTED BASE PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean bottom surface of base plates.

B. Set steel stair base plates on wedges or other adjustable devices. After the stairs have been positioned and aligned, tighten the anchor bolts. Do not remove wedges or shims, but if protruding, cut off flush with the edge of the bearing plate before packing with grout.
   1. Use nonmetallic, nonshrink grout, unless otherwise indicated.
   2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.4 INSTALLING STEEL PIPE RAILINGS AND HANDRAILS

A. Adjust handrails and railing systems prior to anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated or, if not indicated, as required by design loadings. Plumb posts in each direction. Secure posts and railing ends to building construction as follows:

1. Anchor posts to steel by welding directly to steel supporting members.
2. Anchor handrail ends into concrete and masonry with steel round flanges welded to rail ends and anchored into wall construction with drilled-in expansion anchors.

B. Secure handrails to wall with wall brackets and end fittings. Provide bracket with 1 ½ inch clearance from inside face of handrail and finished wall surface. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads. Secure wall brackets and wall return fittings to building construction as follows:

1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.
2. For hollow masonry anchorage, use toggle bolts having square heads.
3. For steel-framed gypsum board assemblies, fasten brackets directly to steel framing or concealed anchors using self-tapping screws of size and type required to support structural loads.

C. Secure metal infill panels to steel tube guardrails with welded steel plates as indicated on the Drawings. Grind all welds smooth prior to finish painting.

3.5 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on steel stairs are specified in Division 9 Section "Painting."

C. For galvanized surfaces, clean welds, bolted connections, and abraded areas and apply galvanizing repair paint to comply with ASTM A 780.

END OF SECTION 05510

SECTION 05520 - ALUMINUM HANDRAILS AND RAILINGS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Wall mounted handrails.

B. Stair railings and guardrails.

C. Free-standing railings at steps.

D. Balcony railings and guardrails.

1.2 RELATED REQUIREMENTS

A. Section 03300 - Cast-in-Place Concrete: Placement of anchors in concrete.

B. Section 04810 - Unit Masonry Assemblies: Placement of anchors in masonry.

C. Section 05510 - Metal Stairs and Railings: Handrails other than those specified in this section.

1.3 REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; American Architectural Manufacturers Association; 1998.

B. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels; 2005.

C. ASTM B211 - Standard Specification for Aluminum and Aluminum-Alloy Bar, Rod, and Wire; 2003.

D. ASTM B211M - Standard Specification for Aluminum and Aluminum-Alloy Bar, Rod, and Wire (Metric); 2003.

E. ASTM B 241/B 241M - Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube; 2002.

F. ASTM B 429/B 429M - Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube; 2006.

G. ASTM B483/B483M - Standard Specification for Aluminum and Aluminum-Alloy Drawn Tubes and Pipe for General Purpose Applications; 2003.

H. ASTM E985 - Standard Specification for Permanent Metal Railing Systems and Rails for Buildings; 2000 (Reapproved 2006).

1.4 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.

C. Samples: Submit two, 6 inch long samples of handrail. Submit two samples of elbow, wall bracket, and end stop.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Handrails and Railings:
1. C. R. Laurence Co., Inc; : www.crlaurence.com.
2. Kee Safety, Inc: www.keesafety.com.
3. Sterling Dula Architectural Products: www.sterlingdula.com.
4. The Wagner Companies: www.wagnercompanies.com.
5. Substitutions: See Section 01600 - Product Requirements.

B. Non-Weld Pipe Fittings:

2.2 RAILINGS - GENERAL REQUIREMENTS

A. Design, fabricate, and test railing assemblies in accordance with the most stringent requirements of ASTM E985 and applicable local code.

B. Allow for expansion and contraction of members and building movement without damage to connections or members.

C. Dimensions: See drawings for configurations and heights.

D. Provide anchors and other components as required to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.

E. Provide slip-on non-weld mechanical fittings to join lengths, seal open ends, and conceal exposed mounting bolts and nuts, including but not limited to elbows, T-shapes, splice connectors, flanges, escutcheons, and wall brackets.

2.3 ALUMINUM MATERIALS

A. Aluminum Pipe: Schedule 40; ASTM B429/B429M, ASTM B241/B241M, or ASTM B483/B483M.

B. Aluminum Tube: Minimum wall thickness of 0.127 inch; ASTM B429/B429M, ASTM B241/B241M, or ASTM B483/B483M.

C. Solid Bars and Flats: ASTM B211 (ASTM B211M).

D. Non-Weld Mechanical Fittings: Slip-on cast aluminum, for Schedule 40 pipe, with flush setscrews for tightening by standard hex wrench, no bolts or screw fasteners.

E. Welding Fittings: No exposed fasteners; cast aluminum.

F. Straight Splice Connectors: Concealed spigot; cast aluminum.

G. Exposed Fasteners: No exposed bolts or screws.

2.4 FABRICATION

A. Accurately form components to suit specific project conditions and for proper connection to building structure.

B. Fit and shop assemble components in largest practical sizes for delivery to site.

C. Fabricate components with joints tightly fitted and secured. Provide spigots and sleeves to accommodate site assembly and installation.

2.5 ALUMINUM FINISHES

A. High Performance Organic Coating System: AAMA 2604 multiple coat, thermally cured fluoropolymer system.

B. Color: To be selected by Architect from manufacturer's standard line.

C. Touch-Up Materials: As recommended by coating manufacturer for field application.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install components plumb and level, accurately fitted, free from distortion or defects, with tight joints.

C. Anchor railings securely to structure.

D. Conceal anchor bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.

3.3 TOLERANCES

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

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

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

END OF SECTION 05520

SECTION 05700 - ORNAMENTAL FENCING AND GATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Ornamental Metal Fencing and Gates.
   2. Motorized Sliding Gate Operator(s).

B. Related Sections include the following:
   1. Division 5 Section "Metal Fabrications" for non-ornamental metal fabrications.
   2. Division 16 Section "Electrical" for coordinating power requirements for gate operators.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated, including finishing materials.

B. Shop Drawings: Show locations of fences, gates, posts, rails, tension wires, details of extended posts, extension arms, gate swing, or other operation, hardware, and accessories. Indicate materials, dimensions, sizes, weights, and finishes of components. Include plans, gate elevations, sections, details of post anchorage, attachment, bracing, and other required installation and operational clearances.
   1. Gate Operator: Show locations and details for installing operator components, switches, and controls. Indicate motor size, electrical characteristics, drive arrangement, mounting, and grounding provisions.
   2. Wiring Diagrams: Power and control wiring and access-control features.
   3. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Samples for Initial Selection: For products involving selection of color, texture, or design.

D. Samples for Verification: For each type of exposed finish required.
   1. Sections of linear shapes.
   2. Full-size Samples of castings and forgings.
      a. For custom castings, submit finished Samples of similar previous work to show ability to reproduce detail, cast-metal color, and quality of finish.

E. Welding certificates.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed chain-link fences and gates similar in material, design, and extent to those indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. UL Standard: Provide gate operators that comply with UL 325.

D. Emergency Access Requirements: Comply with requirements of authorities having jurisdiction for automatic gate operators serving as a required means of access.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store ornamental metal inside a well-ventilated area, away from uncured concrete and masonry, and protected from weather, moisture, soiling, abrasion, extreme temperatures, and humidity.

B. Deliver and store cast-metal products in wooden crates surrounded by sufficient packing material to ensure that products will not be cracked or otherwise damaged.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with ornamental metal by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating railings without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.

B. Interruption of Existing Utility Service: Do not interrupt utility services to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Owner no fewer than two days in advance of proposed interruption of utility services.
2. Do not proceed with interruption of utility services without Owner's written permission.

1.7 COORDINATION

A. Coordinate installation of anchorages for ornamental metal items. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Ornamental Steel Fence & Gates:
a. 2K Steel.
b. FabArc Steel.
c. Marbury Steel Fabricators.

2. Motorized Sliding Gate Operator: Equal to Linear LLC, 1950 Camino Vida Roble, Suite 150, Carlsbad, CA 92008-6517, Ph 800-421-1587, Fax 760-931-1340, www.linearcorp.com.

2.2 METALS, GENERAL

A. DoorKing, Inc. (Operator), 120 S. Glasgow Avenue, Inglewood,CA90301.

B. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

2.3 STEEL AND IRON

A. Tubing: ASTM A 500 (cold formed) or ASTM A 513, Type 5 (mandrel drawn).

B. Bars: Hot-rolled, carbon steel complying with ASTM A 29/A 29M, Grade 1010.

C. Plates, Shapes, and Bars: ASTM A 36/A 36M.

D. Castings: Either gray or malleable iron, unless otherwise indicated.
1. Gray Iron: ASTM A 48/A 48M, Class 30, unless another class is indicated or required by structural loads.
2. Malleable Iron: ASTM A 47/A 47M.

E. Steel Sheet, Cold Rolled: ASTM A 1008/A 1008M, either commercial steel, Type B, or structural steel, Grade 25 (Grade 170), exposed.

2.4 FASTENERS

A. Fasteners for Anchoring to Other Construction: Unless otherwise indicated, select fasteners of type, grade, and class required to produce connections suitable for anchoring indicated items to other types of construction indicated.

B. Provide concealed fasteners for interconnecting components and for attaching ornamental metal items to other work, unless unavoidable.

1. Provide square or hex socket flat-head machine screws for exposed fasteners, unless otherwise indicated.

C. Anchors: Provide cast-in-place or torque-controlled expansion anchors, fabricated from corrosion-resistant materials with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

2.5 FABRICATION, GENERAL

A. Assemble items in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

B. Form ornamental metal to required shapes and sizes, true to line and level with true curves and accurate angles and surfaces. Finish exposed surfaces to smooth, sharp, well-defined lines.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form simple and compound curves in bars and extruded shapes by bending members in jigs to produce uniform curvature for each configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces.

E. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

F. Mill joints to a tight, hairline fit. Cope or miter corner joints. Fabricate connections that will be exposed to weather in a manner to exclude water.

G. Provide weep holes where water may accumulate.

H. Provide necessary rebates, lugs, and brackets to assemble units and to attach to other work. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items, unless otherwise indicated.

I. Comply with AWS for recommended practices in shop welding. Weld behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded joints of flux, and dress exposed and contact surfaces.

J. Provide castings that are sound and free of warp, cracks, blowholes, or other defects that impair strength or appearance. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks.

2.6 FABRICATING ORNAMENTAL FENCING & GATES

A. General: Fabricate ornamental steel to designs indicated from steel bars and shapes of sizes and profiles indicated. Form steel bars by bending, forging, coping, mitering, and welding.

B. Welding: Interconnect grille members with full-length, full-penetration welds, unless otherwise indicated. Use welding method that is appropriate for metal and finish indicated and that develops full strength of members joined. Finish exposed welds and surfaces smooth, flush, and blended to match adjoining surfaces.

C. Brackets, Fittings, and Anchors: Provide wall brackets, fittings, and anchors to connect ornamental fence and gates to other work, unless otherwise indicated.

1. Furnish inserts and other anchorage devices to connect ornamental fence and gates to concrete and steel work. Coordinate anchorage devices with supporting structure.
2. Fabricate anchorage devices that are capable of withstanding loads indicated.
3. Provide all hardware assemblies for motorized sliding gates. This includes truck assemblies, truck hangar brackets, hanger posts, bottom guide assemblies with 3-1/2" hard rubber wheels. Attach hardware assemblies to ornamental fence with ½" U-bolts.

2.7 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

2.8 STEEL AND IRON FINISHES

A. Paint:
1. Shop Primer for Ferrous Metal: Provide fast-curing, lead-free and chromate-free, universal modified alkyd primer complying with performance requirements of FS TT-P- 664, selected for good resistance to normal atmospheric corrosion, compatibility with finish paint systems indicated, and capability to provide a sound foundation for field- applied topcoats despite prolonged exposure.
2. Bituminous Paint: Provide cold-applied asphalt mastic complying with SSPC Paint 12, except containing no asbestos fibers.
3. Finish Paint: Refer to Section 09900 - PAINTING

2.9 INDUSTRIAL HORIZONTAL-SLIDE GATES

A. General: Comply with ASTM F 1184 for single slide gate types.
1. Classification: Type II Cantilever Slide, Class 1 with external roller assemblies.
2. Metal Pipe and Tubing: Galvanized steel. Comply with ASTM F 1184 for materials and protective coatings.

B. Frames and Bracing: Fabricate members from square, galvanized steel tubing with outside dimension and weight according to ASTM F 1184 and the following:
1. Gate Opening Width: As indicated.
2. Frame Members:
a. Tubular Steel: Size as indicated on Drawings.

C. Frame Corner Construction:
1. Welded frame.

D. Roller Guards: As required per ASTM F 1184 for Type II, Class 1 gates.

E. Hardware: Latches permitting operation from both sides of gate, locking devices, roller assemblies and stops fabricated from galvanized steel. Fabricate latches with integral eye openings for padlocking; padlock accessible from both sides of gate.

2.10 MOTORIZED SLIDING GATE OPERATOR

A. Provide gates operators of type and size indicated on Drawings. Equip gates with manufacturer's standard hardware as required for complete functional operation.
1. Type: Sliding, equal to Linear, Model Type GSLG-A-2.
2. Nominal size: Refer to Drawings for gate size, travel distance and gate opening.
3. Electrical: 1/2 HP, 115/230 VAC, single phase, thermally protected, heavy-duty PSC motor; Double C-face brake, Power on/off switch, Emergency stop/reset button on front cover, Duplex receptacle on 115 VAC units, Three-button control station, AC and DC power available for access control accessories and reversing devices, Easily adjustable rotary limit switches.
a. Solid-State Control Circuitry, UL325/UL991 compliant control board, Full featured for access control, security, and entrapment protection.
b. Provide AX Series single channel vehicle detector as manufactured by Reno A&E or

approved equal. This option may be revised to be a siren-activated detector if requested by the Owner/Fire Department.

c. Provide IRB-4X extended range infrared modulated photocell safety device as manufactured by EMX Industries Inc. or approved equal.

d. Mechanical: Heavy-duty 15:1 right-angle C-face gear reducer, #50 roller drive chain and sprockets, Adjustable torque limiter, Heavy-duty pillow-block bearings.

1) Manual Disconnect: Secure, easy, manual operation during power failure or emergency, Optional remote cable kit for outside-the-gate access.

e. Weather-Resistant Cabinet: Galvannealed steel cabinet with powder coat finish, Lockable, gasketed, hinged, and removable front cover.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of ornamental metal.

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

3.2 INSTALLATION, GENERAL

A. Provide anchorage devices and fasteners where needed to secure ornamental metal to in- place construction.

B. Perform cutting, drilling, and fitting required to install ornamental metal. Set products accurately in location, alignment, and elevation; measured from established lines and levels. Provide temporary bracing or anchors in formwork for items to be built into concrete, masonry, or similar construction.

C. Fit exposed connections accurately together to form tight, hairline joints or, where indicated, with uniform reveals and spaces for sealants and joint fillers. Where cutting, welding, and grinding are required for proper shop fitting and jointing of ornamental metal, restore finishes to eliminate evidence of such corrective work.

D. Do not cut or abrade finishes that cannot be completely restored in the field. Return items with such finishes to the shop for required alterations, followed by complete refinishing, or provide new units as required.

E. Install concealed gaskets, joint fillers, insulation, and flashings as work progresses.

F. Restore protective coverings that have been damaged during shipment or installation. Remove protective coverings only when there is no possibility of damage from other work yet to be performed at same location.

G. Field Welding: Comply with applicable AWS specification for procedures of manual shielded metal arc welding, for appearance and quality of welds, and for methods used in correcting welding work. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Grind exposed welded joints smooth and restore finish to match finish of adjacent surfaces.

H. Corrosion Protection: Coat concealed surfaces of metal that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

3.3 INSTALLING ORNAMENTAL METAL FENCE

A. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.

B. Post Setting: Set posts in concrete at indicated spacing on #57 stone on firm, undisturbed soil.
1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
2. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
    a. Concealed Concrete: Top below grade as indicated on Drawings to allow covering with surface material.

3.4 GATE INSTALLATION

A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

3.5 GATE OPERATOR INSTALLATION

A. General: Install gate operators according to manufacturer's written instructions, aligned and true to fence line and grade.

B. Excavation for Support Posts: Hand-excavate holes in firm, undisturbed soil to dimensions and depths and at locations as required by gate-operator component manufacturer's written instructions and as indicated.

C. Comply with NFPA 70 and manufacturer's written instructions for grounding of electric- powered motors, controls, and other devices.

3.6 CLEANING

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

B. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material.

3.7 PROTECTION

A. Protect finishes of ornamental metal from damage during construction period with temporary protective coverings approved by ornamental metal fabricator. Remove protective covering at time of Substantial Completion.

B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION 05700

SECTION 06100 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Structural dimension lumber framing.

B. Non-structural dimension lumber framing.

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

D. Sheathing.

E. Roofing nailers.

F. Preservative treated wood materials.

G. Fire retardant treated wood materials.

H. Miscellaneous framing and sheathing.

I. Communications and electrical room mounting boards.

J. Concealed wood blocking, nailers, and supports.

K. Miscellaneous wood nailers, furring, and grounds.

L. Water-resistive barrier over wall sheathing.

1.2 RELATED REQUIREMENTS

A. Section 05120 - Structural Steel: Prefabricated beams and columns for support of wood framing.

B. Section 05500 - Metal Fabrications: Miscellaneous steel connectors and support angles for wood framing.

C. Section 06132 - Heavy Timber Construction.

D. Section 07311 - Asphalt Shingles

E. Section 07411 - Preformed Metal Roof Panels: Underlayment under metal roofing.

1.3 REFERENCE STANDARDS

A. ANSI A208.1 - American National Standard for Particleboard; 2009.

B. AFPA (WFCM) - Wood Frame Construction Manual for One- and Two-Family Dwellings; American Forest and Paper Association; 2001.

C. ASTM A 153/A 153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

D. ASTM C 1177/C 1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2008.

E. ASTM D 2898 - Standard Test Methods for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing; 2009.

F. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2010.

G. AWPA U1 - Use Category System: User Specification for Treated Wood; American Wood Protection Association; 2010.

H. PS 2 - Performance Standard for Wood-Based Structural-Use Panels; National Institute of Standards and Technology, U.S. Department of Commerce; 2004.

I. PS 20 - American Softwood Lumber Standard; National Institute of Standards and Technology (Department of Commerce); 2005.

J. SPIB (GR) - Grading Rules; Southern Pine Inspection Bureau, Inc.; 2002.

1.4 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide technical data on wood preservative materials and application instructions.
   1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used, net amount of preservative retained, and chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated material.
   2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials, both before and after exposure to elevated temperatures when tested according to ASTM D 5516 and ASTM D 5664.
   3. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

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

D. LEED Submittals: Submit applicable LEED Submittal Form for each different product made of sustainably harvested wood, salvaged and reused wood, wood fabricated from recovered timber, as well as locally-sourced wood, as specified in Section 01355.

1.5 DELIVERY, STORAGE, AND HANDLING

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

B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, or installation.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

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

B. Wood Structural Panels:
1. Plywood: DOC PS 1.
2. Thickness: As needed to comply with requirements specified but not less than thickness indicated.
3. Comply with "Code Plus" provisions in APA Form No. E30K, "APA Design/Construction Guide: Residential & Commercial."
4. Factory mark panels according to indicated standard.

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

2.2 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

A. Grading Agency: Southern Pine Inspection Bureau, Inc. (SPIB).

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

C. Moisture Content: S-dry or MC19.

D. Stud Framing:
1. Species: Southern Pine.
2. Grade: No. 2.

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

2.3 CONSTRUCTION PANELS

A. Roof Underlayment: Refer to Sections 07311 - Asphalt Shingles and Section 07411 - Preformed Metal Roof Panels.

B. Parapet Sheathing: APA PRP-108, Structural I Rated Sheathing, Exterior Exposure Class, and as follows:
1. Span Rating: 24/0.
2. Thickness: 3/4 inch, nominal.

C. Roof Deck Sheathing: Refer to Section 07550 - Modified Bitumen Roofing.

D. Roof Sheathing: Oriented strand board structural wood panel with factory laminated roofing underlayment layer.

1. Sheathing Panel: PS 2, Exposure 1.
   a. Size: 4 feet wide by 8 feet long.
   b. Thickness: 1/2 inch.
   c. Span Rating: 32/16.
   d. Edge Profile: Square edge.

2. Integral Roofing Underlayment Layer: Medium density, phenolic impregnated kraft paper overlay.
3. Exposure Time: Sheathing undamaged and integral roofing underlayment layer intact after exposure to weather for up to 180 days.
4. Provide fastening guide on top panel surface with separate markings indicating fastener spacing for 16 inches and 24 inches on center.
5. Seam Tape: Manufacturer's standard pressure-sensitive, self-adhering, cold-applied seam tape consisting of polyolefin film with acrylic adhesive.

E. Wall Sheathing: Glass mat faced gypsum, ASTM C 1177/C 1177M, square long edges, 5/8 inch Type X fire-resistant.

1. Product: Subject to compliance with requirements, provide "Dens-Glass Gold" by G-P Gypsum Corp.
2. Size: 48 by 96 inches, 108 inches, or 120 inches (Contractor's option) for vertical installation.

F. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood, or medium density fiberboard; 3/4 inch thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E 84.

2.4 ACCESSORIES

A. Fasteners and Anchors: GlassRoc (Sheathing) by CertainTeed Corp, P.O. Box 860, Valley Forge, PA 19482.

1. Metal and Finish: Hot-dipped galvanized steel per ASTM A 153/A 153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
2. Drywall Screws: Bugle head, hardened steel, power driven type, length three times thickness of sheathing.
3. Anchors: Toggle bolt type for anchorage to hollow masonry.

2.5 WATER-RESISTIVE BARRIER:

A. Barrier membrane: High-performance, spunbonded polyolefin, non-woven, non-perforated, weather barrier.

B. Basis of Design: Provide membrane equal to DuPont™ Tyvek® CommercialWrap® and related assembly components.

C. Performance Characteristics:
1. Air Penetration: 0.001 cfm/ft2 at 75 Pa, when tested in accordance with ASTM E2178.
2. Type I per ASTM E1677.
3. Water Vapor Transmission: 28 perms, when tested in accordance with ASTM E96, Method B.
4. Water Penetration Resistance: 280 cm when tested in accordance with AATCC Test
5. Method 127.
6. Basis Weight: 2.7 oz/yd2, when tested in accordance with TAPPI Test Method T-410.
7. Air Resistance: Air infiltration at >1500 seconds, when tested in accordance with TAPPI Test Method T-460.
8. Tensile Strength: 38/35 lbs/in., when tested in accordance with ASTM D882, Method A.
9. Tear Resistance: 12/10 lbs., when tested in accordance with ASTM D1117.
10. Surface Burning Characteristics: Class A, when tested in accordance with ASTM E 84. Flame Spread: 10, Smoke Developed: 10.

D. Membrane Accessories:
1. Seam Tape: 3 inch wide, DuPont™ Tyvek® Tape for commercial applications.
2. Fasteners: 1-5/8 inch rust resistant screw with 2-inch diameter plastic cap or manufacturer approved 1-1/4" or 2" metal gasketed washer.

2.6 FACTORY WOOD TREATMENT

A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
1. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.
2. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.

B. Fire Retardant Treatment:
1. Exterior Type: AWPA U1, Category UCFB, Commodity Specification H, chemically treated and pressure impregnated; capable of providing a maximum flame spread rating of 25 when tested in accordance with ASTM E 84, with no evidence of significant combustion when test is extended for an additional 20 minutes both before and after accelerated weathering test performed in accordance with ASTM D 2898.
a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
b. Do not use treated wood in direct contact with the ground.

C. Preservative Treatment:

1. Preservative Pressure Treatment of Lumber Above Grade: AWPA U1, Use Category UC3B, Commodity Specification A using waterborne preservative to 0.25 lb/cu ft retention.
    a. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
2. Preservative Pressure Treatment of Lumber in Contact with Soil: AWPA U1, Use Category UC4A, Commodity Specification A using waterborne preservative to 0.4 lb/cu ft retention.
    a. Preservative for Field Application to Cut Surfaces: As recommended by manufacturer of factory treatment chemicals for brush-application in the field.
    b. Restrictions: Do not use lumber or plywood treated with chromated copper arsenate (CCA) in exposed exterior applications subject to leaching.

PART 3 - EXECUTION

3.1 PREPARATION

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

3.2 INSTALLATION - GENERAL

A. Select material sizes to minimize waste.

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

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

3.3 FRAMING INSTALLATION

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

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

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

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

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

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

3.4 BLOCKING, NAILERS, AND SUPPORTS

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

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

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

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

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

F. Specifically, provide the following non-structural framing and blocking:
1. Cabinets and shelf supports.
2. Wall brackets.
3. Handrails.
4. Grab bars.
5. Towel and bath accessories.
6. Wall-mounted door stops.
7. Chalkboards and marker boards.
8. Wall paneling and trim.
9. Joints of rigid wall coverings that occur between studs.

3.5 ROOF-RELATED CARPENTRY

A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.

B. Provide wood curb at all roof openings except where specifically indicated otherwise. Form corners by alternating lapping side members.

3.6 INSTALLATION OF CONSTRUCTION PANELS

A. Roof Sheathing: Secure panels with long dimension perpendicular to framing members, with ends staggered and over firm bearing.
1. At long edges use sheathing clips where joints occur between roof framing members.
2. Screw panels to framing; staples are not permitted.

B. Wall Sheathing: Secure with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using nails, screws, or staples.
1. Use plywood or other acceptable structural panels at building corners, for not less than 96 inches, measured horizontally.
2. Place water-resistive barrier horizontally over wall sheathing, weather lapping edges and ends.

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

1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
3. Install adjacent boards without gaps.

3.7 SITE APPLIED WOOD TREATMENT

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

B. Allow preservative to dry prior to erecting members.

3.8 TOLERANCES

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

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

3.9 CLEANING

A. Waste Disposal: Comply with the requirements of Section 01732.
1. Comply with applicable regulations.
2. Do not burn scrap on project site.
3. Do not burn scraps that have been pressure treated.
4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or “waste-to-energy” facilities.

B. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.

C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION 06100

SECTION 06200 - FINISH CARPENTRY

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Finish carpentry items.

B. Interior and exterior running and standing trim.

C. Closet shelving.

D. Wall Panels.

1.2 RELATED REQUIREMENTS

A. Section 06100 - Rough Carpentry: Support framing, grounds, and concealed blocking.

B. Section 06410 - Custom Cabinets: Shop fabricated custom cabinet work.

C. Section 09900 - Paints and Coatings: Painting and finishing of finish carpentry items.

1.3 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; current edition.

B. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2010.

C. AWPA U1 - Use Category System: User Specification for Treated Wood; American Wood-Preservers' Association; 2010.

D. NHLA G-101 - Rules for the Measurement & Inspection of Hardwood & Cypress; National Hardwood Lumber Association; 2007.

1.4 SUBMITTALS

A. See Section 01300 - Administrative Requirements for submittal procedures.

B. Product Data:
   1. Provide data on fire retardant treatment materials and application instructions.

C. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
   1. Provide the information required by AWI/AWMAC/WI Architectural Woodwork Standards.

D. Samples: Submit two samples of finish plywood, 6 x 6 inch in size illustrating wood grain and specified finish.

E. Interior standing and running trim to receive stained finish: 2'-0" x full board or molding width, finished one side and one edge.

F. LEED Report: Submit for wood products made from sustainably harvested wood, salvaged and reused wood, wood fabricated from recovered timber, and locally-sourced wood, as specified in Section 01355.

1.5 QUALITY ASSURANCE

A. Grade materials in accordance with the following:
1. Softwood Lumber: In accordance with rules certified by ALSC; www.alsc.org.
2. Plywood: Certified by the American Plywood Association.
3. Hardwood Lumber: In accordance with NHLA Grading Rules; www.natlhardwood.org.

B. Factory-mark each piece of lumber with type, grade, mill and grading agency identification; except omit marking from surfaces to receive stained finish, and submit mill certificate that material has been inspected and graded in accordance with requirements if it cannot be marked on a concealed surface.

C. Manufacturer Qualifications: Firm experienced in successfully producing architectural woodwork similar to that indicated for this project, with sufficient production capacity to produce required units without causing delay in the work.

D. Single-Source Manufacturing and Installation Responsibility: Engage a qualified manufacturer to assume undivided responsibility for woodwork specified in this section, including fabrication, finishing, and installation.

E. AWI Quality Standard: Comply with applicable requirements of "Architectural Woodwork Quality Standards" published by the Architectural Woodwork Institute (AWI) except as otherwise indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect finish carpentry materials during transit, delivery, storage and handling to prevent damage, soiling and deterioration.

B. Do not deliver finish carpentry materials until painting, wet work, grinding and similar operations which could damage, soil or deteriorate woodwork have been completed in installation areas. If, due to unforeseen circumstances, finish carpentry materials must be stored in other than installation areas, store only in areas meeting requirements specified for installation areas.

C. Protect work from moisture damage.

1.7 JOB CONDITIONS

A. Conditioning: Installer shall advise Contractor of temperature and humidity requirements for finish carpentry installation areas. Do not install finish carpentry until required temperature and relative humidity conditions have been stabilized and will be maintained in installation areas.

B. Maintain temperature and humidity in installation areas as required to maintain moisture content of installed woodwork within a tolerance range of the optimum moisture content acceptable to woodwork manufacturer, from date of installation through remainder of construction period.

PART 2 - PRODUCTS

2.1 FINISH CARPENTRY ITEMS

A. Quality Grade: Unless otherwise indicated provide products of quality specified by AWI//AWMAC/WI Architectural Woodwork Standards for Premium Grade.

2.2 WOOD PRODUCT QUALITY STANDARDS

A. Softwood Lumber Standards: Comply with PS 20 and with applicable grading rules of the respective grading and inspecting agency for the species and product indicated.

B. Hardwood Lumber Standard: Comply with National Hardwood Lumber Association (NHLA) rules.

C. Plywood Standard: Comply with PS 1/ANSI A199.1.

D. Hardwood Plywood Standard: Comply with PS 51.

E. Surface Burning Characteristics: Provide materials having fire and smoke properties as required by applicable code.

2.3 WOOD-BASED COMPONENTS

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

B. Provide sustainably harvested wood, certified or labeled as specified in Section 01600.

2.4 LUMBER MATERIALS

A. General:

1. Nominal sizes are indicated, except as shown by detailed dimensions. Provide dressed or worked and dressed lumber, as applicable, manufactured to the actual sizes as required by PS 20 or to actual sizes and patterns as shown, unless otherwise indicated.
2. Moisture Content of Softwood Lumber: Provide seasoned (KD) lumber having a moisture content from time of manufacture until time of installation not greater than values required by the applicable grading rules of the respective grading and inspecting agency for the species and product indicated.
3. Moisture Content of Hardwood Lumber: Provide kiln-dried (KD) lumber having a moisture content from time of manufacture until time of installation within the ranges required in the referenced woodworking standard.
4. Lumber for Stained Finish: Use pieces which are of solid lumber stock.
5. Lumber for Painted Finish: At Contractor's option, use pieces of lumber which are either glued-up lumber or made of solid lumber stock.

B. Finish Carpentry:

1. Standing and Running Trim for Stained Finish: Plain sawn Cherry manufactured to sizes and patterns (profile) shown from selected First Grade Lumber (NHLA).
2. Standing and Running Trim for Painted Finish: "C & Better" Southern Yellow Pine (SPIB) or any "C Select" or "Choice" Western Softwood (WWPA).
3. Plywood for Stained Finish: Plain sliced select Cherry face veneer on plywood backing, thickness as indicated.
4. Plywood for Painted Finish: 1/2" thick, unless otherwise indicated, Group 1 species, Exposure 1 classification, with solid hardwood banding on all exposed edges, and as follows:
   a. Exposed Both Sides: APA A-A grade.
   b. Exposed One Side: APA A-C grade (Applied over gypsum drywall substrate).
   c. Unexposed: APA B-C grade.
5. Flush Wood Paneling and Wainscots for Stained Finish
   a. Quality Standard: Comply with AWI AWQS, Section 500 requirements for flush wood paneling.
   b. Grade: Provide premium grade.
   c. Wood Species: Cherry.
   d. Matching of Adjacent Veneer Leaves: Provide book match.
   e. Vertical Matching of Adjacent Veneer Leaves: Provide end match.
   f. Veneer Matching Within Panel Face: Provide running match.
   g. Panel Matching Method: Match panels within each separate area by using premanufactured sets used full width.
   h. Vertical Panel Matching Method: Provide end match.
   i. Fire Retardant-Treated Paneling: Provide panels composed of wood veneer and fire retardant-treated particleboard or fire retardant-treated medium density fiberboard.

2.5 WOOD TREATMENT

A. Factory-Treated Lumber: Comply with requirements of AWPA U1 - Use Category System for pressure impregnated wood treatments determined by use categories, expected service conditions, and specific applications.

B. Fire Retardant Treatment (FR-S Type): Chemically treated and pressure impregnated; capable of providing flame spread index of 25, maximum, and smoke developed index of 450, maximum, when tested in accordance with ASTM E84.

C. Provide identification on fire retardant treated material.

2.6 FABRICATION

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

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

C. Wood Moisture Content: Comply with requirements of referenced quality standard for moisture content of lumber in relation to relative humidity conditions existing during time of fabrication and in installation areas.

D. Fabricate woodwork to dimensions, profiles and details indicated. Ease edges to radius indicated for the following:

1. Corners of cabinets and edges of solid wood (lumber) members less than 1 inch in nominal thickness: 1/16 inch.
2. Edges of rails and similar members more than 1 inch in nominal thickness: 1/8 inch.
3. Complete fabrication, including assembly, finishing, and hardware application, before shipment to project site to maximum extent possible. Disassemble components as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

2.7 FASTENERS AND ANCHORS

A. Screws: Select material, type, size and finish required for each use. Comply with FS FF-S- 111 for applicable requirements.

1. For metal framing supports, provide screws as recommended by metal framing manufacturer.

B. Nails: Select material, type, size and finish required for each use. Comply with FS FF-N-105 for applicable requirements.

C. Anchors: Select material, type, size and finish required for secure anchorage to each substrate. Provide nonferrous metal or hot-dip galvanized anchors and inserts at exterior locations, on inside face of exterior walls, in areas of high relative humidity, and elsewhere as required for corrosion resistance. Provide toothed steel or lead expansion bolt devices for drilled-in-place anchors. Furnish inserts and anchors, as required, to be set into concrete or masonry work for subsequent woodwork anchorage.

2.8 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. Prime paint surfaces in contact with cementitious materials.

E. Back prime woodwork items to be field finished, prior to installation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify adequacy of backing and support framing.

B. Condition wood materials to average prevailing humidity conditions in installation areas prior to installing.

C. Backprime lumber for painted finish exposed on the exterior and where exposed to moisture and high relative humidities on the interior. Comply with requirements of Section 09900 - PAINTING for primers and their application.

D. Verify mechanical, electrical, and building items affecting work of this section are placed and ready to receive this work.

3.2 INSTALLATION

A. Install work in accordance with AWI/AWMAC/WI Architectural Woodwork Standards 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. Do not use additional overlay trim to conceal larger gaps.

D. Discard units of material which are unsound, warped, bowed, twisted, improperly treated, not adequately seasoned or too small to fabricate work with minimum of joints or optimum jointing arrangements, or which are of defective manufacturer with respect to surfaces, sizes or patterns.

E. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for complete installation. Except where prefinished fasteners matching fastener heads are required, use fine finishing nails for exposed nailing, countersunk and filled flush with woodwork and matching final finish where transparent finish is indicated.

1. Hammer marks on wood trim will not be accepted.

F. Standing and Running Trim and Rails: Install with minimum number of joints possible, using full-length pieces to the greatest extent possible. Stagger joints in adjacent and related members. Cope at returns and miter at corners, to produce tight fitting joints with full surface contact throughout length of joint. Use scarf joints for end-to-end joints.

G. Wall Panels (and Wainscot): Install plywood panels over gypsum drywall substrate. Drywall shall be taped and mudded, but not sanded and painted, before plywood is installed. Butt joints tightly and fill all joints between panels for a smooth paintable finish.

3.3 PREPARATION FOR SITE FINISHING

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

B. Site Finishing: See Section 09900.

3.4 TOLERANCES

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

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

3.5 CLEANING AND PROTECTION

A. Repair damaged and defective woodwork to eliminate defects functionally and visually; where not possible to repair, remove and replace. Adjust joinery for uniform appearance.

B. Clean woodwork on exposed and semi-exposed surfaces. Touch up finishes as required. Remove and refinish damaged or soiled areas.

C. Remove all trash, crating, etc., from site leaving areas broom clean.

D. Protection: Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensures the woodwork will be without damage or deterioration at time of Substantial Completion.

END OF SECTION 06200

SECTION 06410 - CUSTOM CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. Scope: Provide labor, material, equipment, related services, and supervision required, including, but not limited to, manufacturing, fabrication, erection, and installation for architectural woodwork as required for the complete performance of the work, and as shown on the Drawings and as herein specified.

B. Section Includes:
1. Specially fabricated cabinet units.
2. Plastic laminate countertops.
3. Solid-surface countertops.
4. Cabinet hardware.
5. Preparation for installing utilities.

1.2 RELATED REQUIREMENTS

A. Section 01616 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 06100 - Rough Carpentry: Support framing, grounds, and concealed blocking.

C. Section 06620 - Cast Plastic Fabrications: Cast plastic countertops.

D. Section 08800 - Glazing: Glass for casework.

E. Section 09900 - Paints and Coatings: Site finishing of cabinet exterior.

1.3 REFERENCE STANDARDS

A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2009.

B. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood; Hardwood Plywood & Veneer Association; 2004 (ANSI/HPVA HP-1).

C. NEMA LD 3 - High-Pressure Decorative Laminates; National Electrical Manufacturers Association; 2005.

D. PS 20 - American Softwood Lumber Standard; National Institute of Standards and Technology (Department of Commerce); 2005.

1.4 DEFINITIONS

A. Architectural woodwork includes, but shall not be limited to, wood furring, blocking, shims, hanging strips, etc., as required for installing architectural woodwork items unless concealed within other construction prior to architectural woodwork installation.

1.5 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.

1. Minimum Scale of Detail Drawings: 1-1/2 inch to 1 foot.

C. Provide the information required by AWI/AWMAC/WI Architectural Woodwork Standards. Product Data: Provide data for hardware accessories.

D. Samples: Submit actual samples of architectural cabinet construction, minimum 8 inches square, illustrating proposed cabinet, countertop, and shelf unit substrate and finish.

1. Woodwork products with transparent finish, for each species and cut, finished on one side and on one edge.
2. Woodwork products with opaque finish, for each finish system and color, with one-half of the exposed surface finished.
3. Thermoset decorative overlay surfaced products, for each type, color, pattern, and surface finish.
4. Laminate-clad products, for each type, color, pattern, and surface finish.
5. Solid surfacing materials, 6 inches square for each type, color, pattern, and surface finish.
6. Exposed cabinet hardware, one unit of each type and finish.

E. Quality Control Submittals:

1. Fire Retardant Treatment Data: Submit fire retardant treatment data for material treated to reduce combustibility. Include certification by treating plant that treated materials comply with requirements.
2. Qualification Data: Submit qualification data for firms and persons specified in Quality Assurance Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names of architects and owners, and other information specified.
3. Certification: Submit certification by the manufacturer confirming that wood products contain no added urea-formaldehyde resins.

1.6 QUALITY ASSURANCE

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

1. Company with at least one project in the past 5 years with value of woodwork within 20 percent of cost of woodwork for this Project.
2. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.

B. Regulatory Requirements: Comply with applicable requirements of the laws, codes, ordinances, and regulations of Federal, State, and local authorities having jurisdiction. Obtain necessary approvals from such authorities.

C. Quality Standard: Comply with AWI AWQS for grades of architectural woodwork, construction, finishes, and other requirements. Provide AWI Certification labels or Certificates of Compliance indicating that woodwork meets requirements of grades specified.

D. Surface Burning Characteristics: Provide materials with the following characteristics as determined by testing identical products per ASTM test method indicated below, by Underwriters Laboratories, Inc. (UL), Intertek Testing Services (ITS), or another inspecting and testing agency acceptable to authorities having jurisdiction.

1. Surface burning characteristics shall not exceeding values indicated below, tested per ASTM E 84.
    a. Flame Spread: 25.
    b. Smoke Developed: 450.

1.7 MOCK-UP

A. Prior to installation of the work, fabricate and erect mock-ups for each type of finish and application required to verify selections made under sample submittals and to demonstrate aesthetic effects as well as qualities of materials and execution. Build mock-ups to comply with the following requirements, using materials indicated for final unit of work.

B. Provide mock-up of typical base cabinet, wall cabinet, and countertop, including hardware, finishes, and plumbing accessories.

C. Locate where directed.

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

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the Project site in supplier's or manufacturer's original wrappings and containers, labeled with supplier's or manufacturer's name, material or product brand name, and lot number, if any.

B. Store materials in their original, undamaged packages and containers, inside a well- ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

C. Protect architectural woodwork during transit, delivery, storage, and handling to prevent damage, soilage, and deterioration.

D. Do not deliver architectural woodwork until painting, wet-work, grinding, and similar operations which could damage, soil, or deteriorate architectural woodwork have been completed in installation areas. If architectural woodwork must be stored in other than installation areas, store only in areas meeting requirements specified in Project Conditions Article.

E. Protect units from moisture damage.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install architectural woodwork until building is enclosed, wet-work is completed and nominally dry, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Field Measurements: Take field measurements prior to fabrication of the work and preparation of shop drawings, to ensure proper fitting of the work. Show recorded measurements on final shop drawings. Notify the Owner and the Architect, in writing, of any dimensions found which are not within specified dimensions and tolerances in the Contract Documents, prior to proceeding with the fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Mill-Rite Woodworking Co., Inc.

B. Mortensen Woodwork, Inc.

C. On Site Woodwork Corp.

D. Signature Interior Woodwork Corp.

E. Columbus Cabinets

F. Luttrell Architectural Woodworks

G. Substitutions: See Section 01600 - Product Requirements.

H. Single Source Responsibility: Provide and install this work from single fabricator.

2.2 CABINETS

A. Quality Grade: Unless otherwise indicated provide products of quality specified by AWI//AWMAC/WI Architectural Woodwork Standards for Premium Grade.

B. Wood Veneer Faced Cabinets: Premium grade.
1. Exposed Surfaces: Grade AA, Cherry, plain sliced, slip-matched.
2. Semi-Exposed Surfaces: Grade A, Cherry, rotary cut, random-matched.
3. Concealed Surfaces: Grade B, Cherry, rotary cut, random-matched.

C. Plastic Laminate Faced Cabinets: Custom grade.

2.3 WOOD-BASED COMPONENTS

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

B. Provide sustainably harvested wood, certified or labeled as specified in Section 01600.

C. Hardwood Edgebanding: Use solid hardwood edgebanding matching species, color, grain, and grade for exposed portions of cabinetry.

2.4 MATERIALS

A. General: Provide materials that comply with requirements of the AWI quality standard for each type of architectural woodwork and quality grade indicated and, where the following products are part of the work, with requirements of the referenced product standards that apply to product characteristics indicated.

1. Hardboard: AHA A135.4.
2. Medium Density Fiberboard: ANSI A208.2, Product Class MD-Exterior Glue, formaldehyde-free in accordance with NPA 9.
3. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue, formaldehyde-free.
4. Plywood: DOC PS 1 Provide formaldehyde-free plywood to comply with HUD 24 CFR Part 3280 and HPMA FE.
5. Hardwood Plywood and Face Veneers: HPVA HP-1.

B. High Pressure Decorative Laminate: NEMA LD 3, grades as indicated or, if not indicated, as required by architectural woodwork quality standard.

1. Formica Corp.
2. Laminart, Inc.
3. Micarta Div., Westinghouse Electric Corp.
4. Nevamar Corp.
5. Pionite Decorative Laminates Div., Panolam Industries, Inc.
6. Wilsonart International, Inc.

C. Thermoset Decorative Overlay: ALA 1992, decorative surface of thermally fused polyester or melamine-impregnated web, bonded to specified substrate.

1. Medium density fiberboard.

D. Solid-Surfacing Material: Homogeneous solid sheets of filled plastic resin complying with ISSFA-2.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Avonite, Inc.
   b. E. I. du Pont de Nemours and Company.
   c. Formica Corporation.
   d. Nevamar Company, LLC; Decorative Products Div.
   e. Transolid, Inc.
   f. Wilsonart International; Div. of Premark International, Inc.
2. Product/Manufacturer: Solid sheets equal to Zodiaq® as manufactured by DuPont.
   a. Solid sheets shall be 3/4-inch or 1-1/8-inches for horizontal and vertical applications.
   b. Physical properties shall conform to the manufacturer's standard specifications.
   c. The materials shall not be coated or laminated.
   d. Colors and Patterns: Refer to Drawings for colors and patterns.

2.5 FIRE RETARDANT-TREATED MATERIALS

A. General: Where indicated, use materials impregnated with fire retardant chemical formulations indicated, by a pressure process or by other means acceptable to authorities having jurisdiction, to produce products with surface burning characteristics specified.

1. Fire Retardant Chemicals: Use chemical formulations that do not bleed through or otherwise affect finishes. Do not use colorants in solution to distinguish treated material from untreated material.
2. Formulation: Use interior Type A per AWPA C20.
3. Milling: Mill lumber before treatment and implement special procedures during treatment and drying processes that shall prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of treated architectural woodwork.
4. Drying: Kiln-dry material before and after treatment to levels required for untreated material.
5. Defective Material: Discard treated material that does not comply with requirements of referenced woodworking standard. Do not use twisted, warped, bowed, discolored, or otherwise damaged or defective material.

B. Fire Retardant-Treated Particleboard: Provide panels complying with the following requirements, made from softwood particles and fire retardant chemicals mixed together at time of panel manufacture to achieve products identical to those tested for flame spread and smoke developed per ASTM E 84 by UL, Intertek Testing Services (ITS), or another inspecting and testing agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable inspecting and testing agency.

1. For panels 3/4 inch thick and less and 45 pcf density, comply with ANSI A208.1 for Grade M2, except for the following minimum properties:
    a. Modulus of Rupture: 1600 psi.
    b. Modulus of Elasticity: 300,000 psi.
    c. Internal Bond: 80 psi.
    d. Screw Holding Capacity on Face: 250 lbf.
    e. Screw Holding Capacity on Edge: 225 lbf.
2. For panels 13/16 inch to 1-1/4 inches thick and 44 pcf density, comply with ANSI A208.1 for Grade M1, except for the following minimum properties:
    a. Modulus of Rupture: 1300 psi.
    b. Modulus of Elasticity: 250,000 psi.
    c. Linear Expansion: 0.50 percent.
    d. Screw Holding Capacity on Face: 250 lbf.
    e. Screw Holding Capacity on Edge: 175 lbf.

C. Fire Retardant-Treated Fiberboard: Provide medium density fiberboard panels complying with ANSI A208.2, made from softwood fibers, synthetic resins, and fire retardant chemicals mixed together at time of panel manufacture to achieve products identical to those tested for flame spread and smoke developed per ASTM E 84 by UL, Intertek Testing Services (ITS), or another inspecting and testing agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable inspecting and testing agency.

2.6 ACCESSORIES

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

B. Furring, Blocking, Shims, Hanging Strips, Etc.: Provide fire retardant-treated softwood lumber, kiln-dried to less than 15 percent moisture content.

C. Screws: Select material, type, size, and finish required for each use. Comply with ANSI/ASME B18.6.1 for applicable requirements.

1. For metal framing supports, provide screws as recommended by metal framing manufacturer.

D. Nails: Select material, type, size, and finish required for each use. Comply with FS FF-N-105 for applicable requirements.

E. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide non-ferrous metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance.

2.7 HARDWARE

A. Cabinet Hardware: Provide cabinet hardware and accessory material associated with architectural woodwork cabinets.

1. Standard: Comply with ANSI/BHMA A156.9.
2. Finish for Exposed Hardware: Provide finish that complies with ANSI/BHMA A156.18 and as follows:
    a. Satin Chromium-Plated, on Brass or Bronze Base: BHMA 626.
    b. Satin Chromium-Plated, on Steel Base: BHMA 652.
    c. Satin Stainless Steel, on Stainless Steel Base: BHMA 630.
3. Finish for Concealed Hardware: Provide manufacturer's standard finish that complies with product class requirements of ANSI/BHMA A156.9.
4. Hardware Schedule:
    a. Recessed Brackets and Standards: Heavy Duty, Satin Finish:
        1) Acceptable Manufacturers: Knape and Vogt.
            (a) Standards: 82 decorative heavy duty standard, almond finish, 78 inch long.
            (b) Brackets:
                (1) 182 10-1/2 inch long for 12 inch shelves.
                (2) Shelf clips for cabinet shelves.
    b. Concealed Piano Hinges: Stanley Hardware Div., Stanley Works.
    c. Drawer Extension Guides:
        1) Pencil Drawer:
            (a) Sidewall Mount (100 Pound):
                (1) "3832", Accuride.
                (2) "422.04.XXX", Hafele.
            (b) Top Mount (45 Pound): "C2006", Accuride.
        2) Box Drawer (100 Pound): "7432", Accuride.
        3) File Drawer (150 Pound):
            (a) "4034", Accuride.
            (b) "422.17.XXX", Hafele.

d. Pulls:
   1) "116.39.259", Hafele.
   2) Stanley Hardware Div., Stanley Works (to match above).
   3) EPCO (to match above).
e. Magnetic Catches:
   1) "246.13.740", Hafele.
   2) "SP41" single door or "SP45" double door, Stanley Hardware Div., Stanley Works.
   3) "915", Knape and Vogt.
f. Drawer and Door Locks: Disk tumbler locks, Best cylinder.
   1) "232.18.304" lock, "232.18.313" drawer lock, Hafele.
   2) Best.
g. Concealed Hinge for Overlay Self-Closing Doors:
   1) "329.17.507", duomatic hinges, Hafele.
   2) Grass America.
h. Pull Out Shelf (100 Pound):
   1) "2009", Accuride.
   2) "422.14.XXX", Hafele.
i. Tracks for By-Passing Glass Panels:
   1) "V3134" set, Stanley Hardware Div., Stanley Works.
   2) "Junior 80", Hafele.
j. Grommets.
k. Piano Hinges:
   1) 1) "LSD-30", 18-8 stainless steel, Lamp.
   2) Stanley Hardware Div., Stanley Works (to match above).
   3) Knape and Vogt (to match above).
l. Revolving Bar Latch: "MKTLP", with lock, Lamp.

B. Glass for Doors:
   1. Tempered: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated surfaces), Type I (transparent glass, flat), Class 1 (clear), Quality q3 (glazing select), manufactured by horizontal (roller hearth) process, with exposed edges seamed before tempering, 1/4 inch thick unless otherwise indicated.

2.8 SHOP TREATMENT OF WOOD MATERIALS

A. Provide UL approved identification on fire retardant treated material.

B. Deliver fire retardant treated materials cut to required sizes. Minimize field cutting.

2.9 SITE FINISHING MATERIALS

A. Stain, Shellac, Varnish and Finishing Materials: As specified in Section 09900.

2.10 FABRICATION

A. Comply with requirements of referenced quality standard for wood moisture content in relation to relative humidity conditions existing during time of fabrication and in installation area.

B. Sand fire retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.

C. Fabricate architectural woodwork to dimensions, profiles, and details indicated. Complete fabrication, including, but not limited to, assembly, finishing, and hardware application, before shipment to the Project site to maximum extent possible. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

D. Shop cut openings, to maximum extent possible, to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Smooth edges of cutouts and, where located in countertops and similar exposures, seal edges with a water- resistant coating.

E. Install glass to comply with applicable requirements of Section 08800 - GLAZING and GANA GM. For glass in wood frames, secure glass with removable stops.

2.11 WOOD CABINETS FOR TRANSPARENT FINISH

A. Quality Standard: Comply with AWI AWQS, Section 400 requirements for wood cabinets.

B. Grade: Provide premium grade.

C. Type of Cabinet Construction: Provide flush overlay type.

D. Wood Species for Exposed Surfaces:
1. Species: Mahogany.
2. Grain Matching: Run and match grain vertically.
3. Matching of Veneer Leaves: Book match.
4. Vertical Matching of Veneer Leaves: End match.
5. Veneer Matching Within Panel Face: Running match.

E. Semi-Exposed Surfaces:
1. Surfaces Other Than Drawer Bodies: Match species and cut indicated for exposed surfaces.
2. Drawer Sides and Backs: Solid hardwood lumber, stained to match species indicated for exposed surfaces.
3. Drawer Bottoms: Hardwood plywood.

F. Dust Panels: Provide dust panels of 1/4 inch plywood or tempered hardboard above compartments and drawers except where located directly under countertops.

2.12 LAMINATE-CLAD CABINETS

A. Quality Standard: Comply with AWI AWQS, Section 400 requirements for laminate-clad cabinets.

B. Grade: Provide premium grade.

C. Type of Cabinet Construction: Provide flush overlay type.

D. Laminate Cladding for Exposed Surfaces:
   1. Horizontal Surface Other Than Tops: GP50, 0.050 inch nominal thickness.
   2. Post-Formed Surfaces: PF42, 0.042 inch nominal thickness.
   3. Vertical Surfaces: GP28, 0.028 inch nominal thickness.
   4. Edges: GP28, 0.028 inch nominal thickness.

E. Semi-Exposed Surfaces:
   1. Surfaces Other Than Drawer Bodies: High pressure decorative laminate, CL20, 0.020 inch nominal thickness.
   2. Drawer Sides and Backs: Solid hardwood lumber, shop-finished.
   3. Drawer Bottoms: Thermoset decorative overlay.

F. Dust Panels: Provide dust panels of 1/4 inch plywood or tempered hardboard above compartments and drawers except where located directly under countertops.

G. Colors, Patterns, and Finishes: See Drawings.

2.13 COUNTERTOPS

A. Quality Standard: Comply with AWI AWQS, Section 400 requirements for countertops.

B. Grade: Provide premium grade.

C. Laminated Wood Veneer Countertop: Provide panel product for transparent finish wood veneer laminated over solid core.
   1. Species: As indicated on the Drawings.
   2. Matching of Adjacent Veneer Leaves: Book match.
   3. Edge Treatment: Solid wood matching face for species and cut.
   4. Core Material: Fire retardant-treated particleboard.

D. Plastic Laminate Countertop: Provide high pressure plastic laminate.
   1. Grade: GP50, 0.050 inch nominal thickness.
   2. Colors, Patterns, and Finishes: See Drawings.
   3. Edge Treatment: As indicated on the Drawings.
   4. Core Material: Medium density fiberboard.

E. Solid Surfacing Material Countertop:
   1. Thickness: 3/4 inch.
   2. Colors, Patterns, and Finishes: See Drawings.
   3. Fabrication: Fabricate tops in one-piece with shop-applied backsplashes and edges, unless otherwise indicated. Comply with solid surface material manufacturer's recommendations for adhesives, sealers, fabrication, and finishing.
      a. Install integral sink bowls in countertops in the shop.
      b. Drill holes in countertops for plumbing fixtures and soap dispensers in the shop.

F. Stone Countertop:
1. Thickness: 3/4 inch.
2. Panel Size: As indicated on drawings.
3. Fabrication Tolerances: In accordance with NBGQA (SPEC).
4. Fabricate units for uniform coloration between adjacent units and over the full area of the installation.
5. Where corner detail is not indicated, form external corners to quirk joint profile.
6. Cut drip slot in bottom surface of work projecting more than 1/2 inch over wall openings. Size slot not less than 3/8 inch wide and 1/4 inch deep; full width of projection.

2.14 FINISHING OF ARCHITECTURAL WOODWORK

A. Quality Standard: Comply with AWI AWQS, Section 1500, unless otherwise indicated.

B. General: Refer to Section 09900 - PAINTING for final finishing of installed architectural woodwork and for material and application requirements of prime coats for architectural woodwork not specified to receive final finish in this Section.

C. Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural woodwork, as applicable to each unit of work.
1. Backpriming: Apply one coat of sealer or primer compatible with finish coats to concealed surfaces of architectural woodwork, including, but not limited to, backs of cabinets and paneling, and the underside of countertops. Apply two coats to the back of paneling. Concealed surfaces of plastic laminate-clad woodwork do not require backpriming when surfaced with plastic laminate or thermoset decorative overlay.

D. Transparent Finishes: Comply with requirements indicated below for grade, finish system, staining, and sheen, with sheen measured on 60 degree gloss meter per ASTM D 523.
1. Grade: Premium.
2. Finish System: AWI Finish System TR-3 (water reducible acrylic lacquer).
3. Staining: Match the Architect's sample.
4. Sheen: Gloss, 80 to 100 gloss units.
5. Washcoat for Stained Finish: Apply a vinyl washcoat to architectural woodwork made from closed grain wood before staining and finishing.
6. Open Finish for Open Grain Woods: Do not apply filler to open grain woods.
a. Apply vinyl washcoat sealer after staining and before filling. PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify adequacy of backing and support framing.

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

3.2 PREPARATION

A. Condition architectural woodwork to average prevailing humidity conditions in installation areas before installing.

B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including, but not limited to, backpriming and removal of packing.

3.3 INSTALLATION

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

B. Quality Standard: Install architectural woodwork to comply with AWI AWQS, Section 1700 for the same grades specified in Part 2 - PRODUCTS of this Section for type of architectural woodwork involved.

C. Installation Tolerances: Install architectural woodwork plumb, level, true, and straight with no distortions. Shim as required with concealed shims.

1. Variation From Plumb and Level: ±1/8 inch in any 96 inch dimension.
2. Offset In Flush Adjoining Surfaces: ±1/16 inch maximum.
3. Offset In Revealed Adjoining Surfaces: ±1/8 inch maximum.

D. Fitting: Scribe and cut architectural woodwork to fit adjoining work and refinish cut surfaces or repair damaged finish at cuts.

E. Fire Retardant-Treated Wood: Handle, store, and install fire retardant-treated wood to comply with recommendations of chemical treatment manufacturer, including, but not limited to, those for adhesives used to install architectural woodwork.

F. Fasteners: Anchor architectural woodwork to anchors or blocking built-in or directly attached to substrates. Secure to grounds, stripping, and blocking with countersunk, concealed fasteners and blind nailing as required for a complete installation. Use fine finishing nails for exposed nailing, countersunk and filled flush with architectural woodwork and matching final finish where transparent finish is indicated.

G. Cabinets: Install without distortion so that doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete the installation of hardware and accessory items as indicated. Install cabinets with no more than 1/8 inch in 96 inches for sag, bow, or other variation from a straight line.

1. Maintain veneer sequence matching of cabinets with transparent finish.

H. Countertops: Anchor securely to base units and other support systems as indicated. Caulk space between backsplash and wall with specified sealant. Install countertops with no more than 1/8 inch in 96 inches for sag, bow, or other variation from a straight line.

1. Align adjacent solid surfacing countertops and form seams to comply with manufacturer's written recommendations, using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

I. Paneling: Anchor paneling to supporting substrate with concealed panel hanger clips and by blind nailing on back-up strips, splined connection strips, or similar associated trim and framing. Do not face nail unless otherwise indicated. Install paneling flush with no more than 1/16 inch in 96 inches vertical cup and bow and 1/8 inch in 96 inches horizontal variation from a true plane.

J. Finishing: Complete the finishing work specified in this Section to the extent not completed at the shop or before installation of the architectural woodwork. Fill nail holes with matching filler where exposed. Apply specified finish coats, including, but not limited to, stains and paste fillers (if any), to exposed surfaces where only seal or prime coats were applied in the shop.

3.4 ADJUSTING AND CLEANING

A. Repair damaged and defective architectural woodwork where possible to eliminate functional and visual defects. Where not possible to repair, replace architectural woodwork. Adjust joinery for visual appearance.

B. Clean architectural woodwork on exposed and semi-exposed surfaces. Touch-up shop- applied finishes to restore damaged or soiled areas.

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

D. Repair damaged and defective architectural woodwork where possible to eliminate functional and visual defects. Where not possible to repair, replace architectural woodwork. Adjust joinery for visual appearance.

3.5 PROTECTION

A. Provide final protection and maintain conditions in a manner acceptable to the Installer, that shall ensure that the architectural woodwork shall be without damage at time of Substantial Completion.

END OF SECTION 06410

SECTION 06620 - CAST PLASTIC FABRICATIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Cast plastic window sills, washroom vanities and counter top.

1.2 REFERENCE STANDARDS

A. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2010.

B. NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association; 2009, Revision 1 - 2010.

C. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.3 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate dimensions, thicknesses, required clearances, tolerances, materials, colors, finishes, fabrication details, field jointing, adjacent construction, design load parameters, methods of support, integration of plumbing components, and anchorages.

C. Product Data: Provide data on specified component products, electrical characteristics and connection requirements.

D. Samples: Submit two samples representative of vanity top, 4 x 4 inch in size, illustrating color, texture, and finish.

E. Manufacturer's Installation Instructions: Indicate preparation of opening required, rough-in sizes; provide templates for cast-in or placed frames or anchors; tolerances for item placement, temporary bracing of components.

F. Maintenance Data: Indicate list of approved cleaning materials and procedures required; list of substances that are harmful to the component materials, lubrication and cleaning procedures for circulating pump.

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

1.4 QUALITY ASSURANCE

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

1.5 WARRANTY

A. See Section 01780 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Cast Plastic Fabrications:
   1. Substitutions: See Section 01600 - Product Requirements.

2.2 MATERIALS

A. Provide finished products having flame spread index of 35 and smoke developed index of 15, when tested in accordance with ASTM E 84 in thickness of 3/4 inch.

B. Resin: Polyester type, with integral coloring, stain resistant to domestic chemicals and cleaners.

2.3 FABRICATION

A. Fabricate components by mold to achieve shape and configuration.

B. Gel coat the finish exposed surfaces smooth and polish to a gloss sheen.

C. Radius corners and edges.

D. Cure components prior to shipment, except sheet materials requiring site handling.

2.4 FINISH

A. Color: Refer to Drawings for color.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that joint preparation and affected dimensions are acceptable.

C. Verify mechanical, electrical, and building items affecting work of this section are placed and ready to receive this work.

3.2 PREPARATION

A. Provide anchoring devices for installation and embedding.

3.3 INSTALLATION

A. Install components in accordance with shop drawings and manufacturer's instructions.

B. Align work plumb and level.

C. Rigidly anchor to substrate to prevent misalignment.

3.4 TOLERANCES

A. Maximum Variation From True Dimension: 1/8 inch.

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

3.5 CLEANING

A. Clean and polish fabrication surfaces in accordance with manufacturer's instructions.

END OF SECTION 06620

SECTION 07115 - BITUMINOUS DAMPPROOFING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. This Section includes cold-applied emulsified- asphalt dampproofing applied to the following surfaces:
1. Exterior face of inner wythe of exterior masonry cavity walls.
2. Exterior face of metal stud and sheathing back-up cavity walls.

1.2 REFERENCE STANDARDS

A. ASTM D 1227 - Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing; 1995 (Reapproved 2007).

B. ASTM D 2822 - Standard Specification for Asphalt Roof Cement, Asbestos-Containing; 2005.

C. ASTM D 3747 - Standard Specification for Emulsified Asphalt Adhesive for Adhering Roof Insulation; 1979 (Reapproved 2007).

1.3 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide properties of primer, bitumen, and mastics.

C. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain primary dampproofing materials and primers through one source from a single manufacturer. Provide secondary materials recommended by manufacturer of primary materials.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum three years' experience.

1.5 FIELD CONDITIONS

A. Ventilation: Provide adequate ventilation during application of dampproofing in enclosed spaces. Maintain ventilation until dampproofing has thoroughly cured.

B. Maintain ambient temperatures above 40 degrees F for 24 hours before and during application until dampproofing has cured.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. 1. Cold-Applied, Emulsified-Asphalt Dampproofing:
   a. Euclid Chemical Company (The).
   b. Gardner Asphalt Corporation.
   c. Henry Company.
   d. Karnak Corporation.
   e. Koppers Industries, Inc.
   f. Malarkey Roofing Company.
   g. Meadows, W. R., Inc.
   h. Sonneborn, Div. of ChemRex, Inc.
   i. Tamms Industries.

2.2 COLD ASPHALTIC MATERIALS

A. Cold-Applied, Emulsified-Asphalt Dampproofing:

1. Trowel Coats: ASTM D 1227, Type II, Class 1.
2. Fibered Brush and Spray Coats: ASTM D 1227, Type II, Class 1.
3. Brush and Spray Coats: ASTM D 1227, Type III, Class 1.

B. Emulsified-Asphalt Primer: ASTM D 1227, Type III, Class 1, except diluted with water as recommended by manufacturer.

C. Sealing Mastic: Asphalt roof cement, ASTM D 2822, Type I.

PART 3 - EXECUTION

3.1 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.

3.2 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.

3.3 APPLICATION, GENERAL

A. Comply with manufacturer's written recommendations unless more stringent requirements are indicated or required by Project conditions to ensure satisfactory performance of dampproofing.

1. Apply additional coats if recommended by manufacturer or required to achieve a "pin-hole free" coverage.
2. Allow each coat of dampproofing to cure 24 hours before applying subsequent coats.

B. Apply dampproofing to provide continuous plane of protection on exterior face of inner wythe of exterior masonry cavity walls.

1. Lap dampproofing at least 1/4 inch onto flashing, masonry reinforcement, veneer ties, and other items that penetrate inner wythe.
2. Extend dampproofing over outer face of structural members and concrete slabs that interrupt inner wythe, and lap dampproofing at least 1/4 inch onto shelf angles supporting veneer.

3.4 APPLICATION AT CAVITY WALLS

A. On Exterior Face of Inner Wythe of Cavity Walls: Apply primer and one brush or spray coat at not less than 1 gal./100 sq. ft. Apply additional coats as required to obtain “pin-hole free” coverage of all surfaces.

3.5 CLEANING

A. Remove dampproofing materials from surfaces not intended to receive dampproofing.

END OF SECTION 07115

SECTION 07130 - SHEET WATERPROOFING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Rubberized-asphalt sheet waterproofing, fabric reinforced.

1.2 RELATED REQUIREMENTS

A. Section 03300 - Cast-in-Place Concrete: Concrete substrate.

B. Section 07212 - Board and Batt Insulation: Insulation used for protective cover.

C. Section 07620 - Sheet Metal Flashing and Trim: Metal parapet, coping, and counterflashing.

D. Section 07900 - Joint Sealers: Sealant for joints in substrates.

1.3 REFERENCE STANDARDS

A. ASTM D 412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension; 2006a.

B. ASTM D 570 - Standard Test Method for Water Absorption of Plastics; 1998 (Reapproved 2005).

C. ASTM D 624 - Standard Test Method For Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers; 2000 (Reapproved 2007).

D. ASTM D 746 - Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact; 2007.

E. ASTM D 1621 - Standard Test Method for Compressive Properties of Rigid Cellular Plastics; 2010.

F. NRCA ML104 - The NRCA Roofing and Waterproofing Manual; National Roofing Contractors Association; Fifth Edition, with interim updates.

1.4 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for membrane.

C. Shop Drawings: Indicate special joint or termination conditions and conditions of interface with other materials.

D. Certificate: Certify that products meet or exceed specified requirements.

E. Manufacturer's Installation Instructions: Indicate special procedures.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with NRCA Roofing and Waterproofing Manual for system.

B. Membrane Manufacturer Qualifications: Company specializing in waterproofing sheet membranes with three years' experience.

C. Installer Qualifications: Company specializing in performing the work of this section with minimum three years' experience.

1.6 MOCK-UP

A. Construct mockup 100 sq ft of horizontal waterproofed panel; to represent finished work including internal and external corners.

B. Locate where directed.

C. Mockup may remain as part of the Work.

D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review requirements for waterproofing, including surface preparation specified under other Sections, substrate condition and pretreatment, minimum curing period, forecasted weather conditions, special details and sheet flashings, installation procedures, testing and inspection procedures, and protection and repairs.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver liquid materials to Project site in original packages with seals unbroken, labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by waterproofing manufacturer.

C. Remove and replace liquid materials that cannot be applied within their stated shelf life.

D. Store rolls according to manufacturer's written instructions.

E. Protect stored materials from direct sunlight.

1.8 FIELD CONDITIONS

A. Maintain ambient temperatures above 40 degrees F for 24 hours before and during application and until liquid or mastic accessories have cured.

1.9 WARRANTY

A. See Section 01780 - Closeout Submittals, for additional warranty requirements.

B. Contractor shall correct defective Work within a five year period after Date of Substantial Completion; remove and replace materials concealing waterproofing at no extra cost to Owner.

C. Provide five year manufacturer warranty for waterproofing failing to resist penetration of water, except where such failures are the result of structural failures of building. hairline cracking of concrete due to temperature change or shrinkage is not considered a structural failure.

D. Special Installer's Warranty: Written waterproofing Installer's warranty, signed by Installer, covering Work of this Section, for warranty period of two years.
1. Warranty includes removing and reinstalling protection board.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. W. R. Grace & Co.; Bituthene 5000, or approved equal.

B. Other Acceptable Rubber Manufacturers:
1. Carlisle Coatings & Waterproofing, Inc: www.carlisle-ccw.com.
2. Firestone Building Products Co: www.firestonebpco.com.
3. Substitutions: See Section 01600 - Product Requirements.

2.2 RUBBERIZED-ASPHALT SHEET WATERPROOFING

A. Rubberized-Asphalt Sheet, Fabric Reinforced: 60-mil- thick, self-adhering sheet consisting of rubberized-asphalt membrane embedded in spun-bonded polyester or fiberglass nonwoven fabric reinforcement laminated to a 0.50-mil- thick, polyester film with release liner on adhesive side, with the following physical properties measured per standard test methods referenced:
1. Physical properties below represent common values published by both manufacturers. Add other physical properties if required.
a. Pliability: No cracks when bent 180 degrees over a 1-inch mandrel at minus 25 deg F; ASTM D 146.
b. Hydrostatic-Head Resistance: 150 feet minimum.
c. Vapor Permeance: 0.05 perms; ASTM E 96, Water Method.

2.3 ACCESSORIES

A. General: Furnish all necessary auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing, and as required for a complete and warrantable installation. Auxiliary materials may include, but are not limited to, primers or other surface conditioners, sheet detailing strips, substrate patching materials, mastic, adhesives, and tapes.
1. Furnish liquid-type auxiliary materials that comply with VOC limits of authorities having jurisdiction.

B. Metal Termination Bars: Aluminum bars, approximately 1 by 1/8 inch thick, predrilled at 9- inch centers.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify substrate surfaces are durable; free of matter detrimental to adhesion or application of waterproofing system.

C. Verify that items that penetrate surfaces to receive waterproofing are securely installed.

3.2 PREPARATION

A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.

B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.

C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids.

E. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D 4258.

F. Install sheet strips and center over treated construction and contraction joints and cracks exceeding a width of 1/16 inch.

G. Bridge and cover isolation joints and expansion joints as detailed on the drawings.

H. Corners: Prepare, prime, and treat inside and outside corners according to ASTM D 6135.

I. Install membrane strips centered over vertical inside corners. Install 3/4-inch fillets of liquid membrane on horizontal inside corners and as follows:

1. At footing-to-wall intersections, extend liquid membrane each direction from corner or install membrane strip centered over corner.
2. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and protrusions according to ASTM D 6135.

3.3 INSTALLATION - MEMBRANE

A. Install self-adhering sheets according to waterproofing manufacturer's written instructions and recommendations in ASTM D 6135.

B. Apply primer to substrates at required rate and allow to dry. Limit priming to areas that will be covered by sheet waterproofing in same day. Reprime areas exposed for more than 24 hours.

C. Apply and firmly adhere sheets over area to receive waterproofing. Accurately align sheets and maintain uniform 2-1/2-inch- minimum lap widths and end laps. Overlap and seal seams and stagger end laps to ensure watertight installation.

D. When ambient and substrate temperatures range between 25 and 40 deg F, install self- adhering, rubberized-asphalt sheets produced for low-temperature application. Do not use low-temperature sheets if ambient or substrate temperature is higher than 60 deg F.

E. Apply continuous sheets over sheet strips bridging substrate cracks, construction, and contraction joints.

F. Seal exposed edges of sheets at terminations not concealed by metal counterflashings or ending in reglets with mastic or sealant.

G. Install sheet waterproofing and auxiliary materials to tie into adjacent waterproofing.

H. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Slit and flatten fishmouths and blisters. Patch with sheets extending 6 inches beyond repaired areas in all directions.

I. Correct deficiencies in or remove sheet waterproofing that does not comply with requirements, repair substrates, reapply waterproofing, and repair sheet flashings.

J. Seal membrane and flashings to adjoining surfaces. Install termination bar at all edges. Install counterflashing over all exposed edges.

3.4 PROTECTION

A. Protect waterproofing from damage and wear during remainder of construction period.

B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 07130

SECTION 07150 - HOT-APPLIED RUBBERIZED WATERPROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Furnish and install a completed waterproofing assembly including surface conditioner, a monolithic, rubberized asphalt membrane, protection course, flashings, extruded polystyrene insulation, drainage course and concrete pavers.

1.3 RELATED REQUIREMENTS

A. Section 03300 - Cast-in-Place Concrete: Concrete substrate.

B. Section 07620 - Sheet Metal Flashing and Trim: Metal counterflashings.

C. Section 07900 - Joint Sealers: Sealant for joints in substrates.

D. Section 15146 - Plumbing Specialties: Roof drain flashing flanges.

1.4 REFERENCE STANDARDS

A. ASTM D 412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension; 2006a.

B. ASTM D 429 - Standard Test Methods for Rubber Property--Adhesion to Rigid Substrates; 2003.

C. ASTM D 471 - Standard Test Method for Rubber Property--Effect of Liquids; 2006.

D. ASTM D 624 - Standard Test Method For Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers; 2000 (Reapproved 2007).

E. ASTM D 746 - Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact; 2007.

F. ASTM E 96/E 96M - Standard Test Methods For Water Vapor Transmission of Materials; 2005.

G. NRCA ML104 - The NRCA Roofing and Waterproofing Manual; National Roofing Contractors Association; Fifth Edition, with interim updates.

1.5 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for membrane.

C. Certificate: Certify that products meet or exceed specified requirements.

D. Manufacturer's Installation Instructions: Indicate special procedures.

E. Warranty: Submit manufacturer warranty and ensure forms have been completed in Vortex Business Center's name and registered with manufacturer.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with NRCA Roofing and Waterproofing Manual for specified system.

B. Membrane Manufacturer Qualifications: Company specializing in waterproofing sheet membranes with three years' experience.

C. Installer Qualifications: Company specializing in performing the work of this section with minimum three years' experience.

1.7 MOCK-UP

A. Construct mock-up 100 sq ft of horizontal waterproofed panel; to represent finished work including internal and external corners.

B. Locate where directed.

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

1.8 FIELD CONDITIONS

A. Maintain ambient temperatures above 40 degrees F for 24 hours before and during application and until cured.

1.9 WARRANTY

A. See Section 01780 - Closeout Submittals, for additional warranty requirements.

B. Contractor shall correct defective Work within a five year period after Date of Substantial Completion; remove and replace materials concealing waterproofing at no cost to Vortex Business Center.

C. Provide five year manufacturer warranty for waterproofing failing to resist penetration of water and, except where such failures are the result of structural failures of building. Hairline cracking of concrete due to temperature change or shrinkage is not considered a structural failure.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Rubberized Asphalt Manufacturers:
   1. American Hydrotech, Inc: www.hydrotechusa.com.
   2. Barrett Company: www.barrettroofs.com.
   3. Carlisle Coatings & Waterproofing, Inc: www.carlisle-ccw.com.

B. Substitutions: See Section 01600 - Product Requirements.

2.2 MEMBRANE MATERIALS

A. Fluid-Applied Waterproofing - General: Rubberized asphalt fluid-applied membrane.

B. Product/Manufacturer: Monolithic Membrane 6125-EV (25% min. post consumer recycled content) as manufactured by American Hydrotech or equal product from an approved manufacturer.

C. Membrane shall be a hot, fluid applied, rubberized asphalt membrane meeting the following CGSB-37.50-M89 standard and other pertinent physical properties:

PROPERTY	**TEST METHOD**	**TYPICAL RESULT**
Flash point	ASTM D-92	502°F*
Penetration	ASTM D-5329	98 mm @77°F 187 mm @122°F
Flow	ASTM D-5329	1.0 mm @ 140°F (60°C)
Toughness	CGSB-37.50-M89	16.0 Joules
Ratio to Pk Load	CGSB-37.50-M89	0.069
Vapor Perm.	ASTM E-96, E	0.3 ng/Pa(s)M2
Water Absorp.	CGSB-37.50-M89	.11 gram weight gain
Low Temp Flex	CGSB-37.50-M89	No delamin., adhesion loss, or cracking
Low Temp Crack	CGSB-37.50-M89	No cracking, adhesion loss, or splitting
Heat Stability	CGSB-37.50-M89	No change in visc, flow, low temp flex
Viscosity	CGSB-37.50-M89	11.0 seconds
Water Resist.	CGSB-37.50-M89	No delamin., blistering, or deterioration
Softening Point	ASTM D-36	ASTM D-36
Elongation	ASTM D-5329	1000% minimum
Resiliency	ASTM D-3407	40% minimum
Bond to Conc.	ASTM D-3407	Pass 0°F (-18°C)
Acid Resist.	ASTM D-896 7.1	Pass-50% Nitric Acid -50%
Sulf Acid Resis to Hydro	ASTM D-08.22 D 2	100 psi (equals 231 foot of head water)
Resist to Salt	ASTM D-896	No delamin, blistering, or deterioration
Resist to Fertil.	ASTM D-896	No delamin, blistering, or deterioration
Resist to Waste	3-year exposure	No deterioration
Solids Content	100%-no solvents	

2.3 ACCESSORIES

A. Surface Conditioner:
   1. A surface conditioner for concrete surfaces.
      a. Equal to American Hydrotech, Inc., Surface Conditioner.

B. Flashing/Reinforcing:
   1. 60-mil (1.5 mm) thick, uncured neoprene flashing/reinforcing sheet.
      a. Equal to American Hydrotech, Inc., Flex Flash UN.

C. Adhesives/Sealant:
   1. Contact adhesive to bond elastomeric flashing together.
      a. Equal to American Hydrotech, Inc., Splicing Cement.
      b. Contact adhesive to bond elastomeric flashing to an approved substrate.
         1) Equal to American Hydrotech, Inc., Bonding Adhesive.
      c. Sealant to seal elastomeric flashing seam edge.
         1) Equal to American Hydrotech, Inc., Lap Sealant.

D. Protection Course:
   1. A fiberglass reinforced rubberized asphalt sheet.
      a. Equal to American Hydrotech, Inc., Hydroflex 30.

E. Prefabricated Drainage Course:
   1. A composite drainage system consisting of a three-dimensional, crush-proof, drainage core and a filter fabric meeting the following physical properties.
      a. Equal to American Hydrotech, Inc., Hydrodrain 300, 400, 700 or 1000 series.

F. Insulation:
   1. An extruded polystyrene rigid board insulation meeting the following physical properties.
      a. Equal to STYROFOAMd Brand insulation as manufactured by The Dow Chemical Company, marketed by American Hydrotech, Inc.
   2. Insulation shall meet ASTM C-578, Type VI or VII.
   3. Minimum compressive strength, ASTM D-1621, 60 psi.
   4. Maximum water absorption by volume per ASTM C-272, 0.1%.
   5. Water vapor permeance for 1" product per ASTM E-96, 1.0 perm (max.).
   6. Insulation shall have an R value of 5.0 F ft2 h/Btu/in. (0.88 K m2/W) of thickness when tested at 75°F mean temperature in accordance with ASTM C-518.
   7. Product shall be free of CFC's.
   8. Product: Equal to STYROFOAMd Brand Plaza Deck; High Load 100; and Square Edge.

G. Filter Fabric Sheet:
   1. Water permeable polymeric fabric.
      a. Equal to American Hydrotech, Inc., Filter Fabric Sheet

H. Pavers:
   1. Architectural Concrete Pavers
      a. Equal to American Hydrotech, Inc., Architectural Pavers, 2" thick, 24" x 24" square, meeting the following physical properties:

PROPERTY	**TEST METHOD**	**VALUES**
Flexural Strength	ASTM C293	>1,100 psi average min
Water Absorption	ASTM C140	Not greater than 5%
Freeze/Thaw	ASTM C67	<1% loss/dry weight (50 Cycles)
Centerload Min.	1,750 lbs	

   2. Paver Accessories:
      a. Fixed Height pedestals as recommended by manufacturer.
      b. Adjustable Height pedestals as recommended by manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify substrate surfaces are free of frozen matter, dampness, loose particles, cracks, pits, projections, penetrations, or foreign matter detrimental to adhesion or application of waterproofing system.

C. Verify that substrate surfaces are smooth, free of honeycomb or pitting, and not detrimental to full contact bond of waterproofing materials.

D. The waterproofing contractor shall not proceed with the installation of the waterproof membrane assembly until all deck defects have been corrected. Verify that items that penetrate surfaces to receive waterproofing are securely installed.

3.2 PREPARATION

A. Protect adjacent surfaces not designated to receive waterproofing.

B. Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's instructions.

C. Do not apply waterproofing to surfaces unacceptable to manufacturer.

D. Seal cracks and joints with sealant using methods recommended by sealant manufacturer.

E. Thoroughly sweep the substrate which is to receive the waterproofing membrane.

F. Substrate must also be blown clean using an air compressor to remove any remaining loose debris.

G. Final check to determine if concrete has been properly cleaned is to apply a test patch of Monolithic Membrane 6125 to the surface and check its adhesion.

3.3 INSTALLATION

A. Surface conditioner application to concrete:
   1. Apply the surface conditioner to the concrete using a hand held sprayer evenly at a rate of 300 to 600 SF/gallon depending on surface texture. Surface conditioner should "tan" the surface, not blacken it.
   2. Allow sufficient time for the surface conditioner to thoroughly dry prior to the membrane application.

B. Membrane preparation:
   1. The membrane shall be heated in double jacketed, oil bath or hot air melter with mechanical agitation, specifically designed for the preparation of a rubberized asphalt membrane.
   2. Heat membrane until membrane can be drawn-free flowing at a temperature range between 350°F and 400°F.

C. Detailing/Flashing:
1. All detailing and flashing shall be done in accordance with the manufacturer's standard Guideline Details.
2. All detailing and flashing shall be completed before installing the membrane over the field of the substrate.

D. Membrane Application:
1. Apply the rubberized asphalt membrane at a rate to provide a continuous, monolithic coat of 180 mil minimum (approximately 3/15"), but not less than 125 mil (1/8") thickness.

3.4 SEPARATION SHEET INSTALLATION

A. Protection layer shall be installed as follows:
1. Embed the protection sheet into the membrane while it is still hot to insure a good bond.
2. Overlap adjoining sheet edges (dry) a minimum of 2"-3" (50.8 mm - 76.2 mm) to insure complete coverage. Rigid insulation board materials are not to be overlapped.
3. The completed membrane/protection assembly must be covered with subsequent topping materials as soon as possible, within 30 days of membrane installation.

3.5 WATER TEST

A. The deck area shall be water tested by means of electronic testing or ponding water to a minimum depth of 2" for a period of 48 hours to check the integrity of the membrane installation.

B. Verify that the structure can support the deadload weight of a water test before testing.

C. If leaks should occur, the water must be drained completely and the membrane installation repaired.

3.6 DRAINAGE COURSE/INSULATION/FILTER FABRIC SHEET/PAVER PLACEMENT

A. General:
1. Examine the deck area to be covered with subsequent topping materials in order to ensure that all deck areas have received the membrane, the membrane is free of damage, it is properly protected, and all flashing has been properly installed, before placing the insulation.
2. It is recommended that the drainage course, insulation, and other subsequent topping materials be installed as each section is completed.

B. Prefabricated Drainage Course Placement:
1. Install drainage course on horizontal and vertical surfaces in accordance with the manufacturer's recommendations.
2. Layout and position drainage course and allow to lay flat. Cut and fit drainage course to perimeter and penetrations.
3. Bond all geotextile overlap edges to adjacent drainage core geotextile with an acceptable adhesive to insure geotextile integrity.

C. Place subsequent topping materials as soon as possible.

D. Insulation Placement:
   1. Loose lay horizontal applications in a staggered manner and tightly butt together all insulation boards. The maximum acceptable opening between insulation boards is 3/8". Insulation must be installed within 3/4" of all projections, penetrations, etc.
   2. When multi-layer insulation applications are involved the bottom layer of insulation must be the thickest layer and must be a minimum of 2" thick. All layers shall be installed unadhered to each other and all joints in relation to underlying layers staggered.

E. Architectural Finish Paver Placement:
   1. Install architectural finish pavers on tabs or pedestals in accordance with manufacturer's recommendations and architectural layout.

3.7 PROTECTION

A. Do not permit traffic over unprotected or uncovered membrane.

END OF SECTION 07150

SECTION 07162 - CRYSTALLINE WATERPROOFING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Crystalline waterproofing.

B. Preparation of surfaces to be waterproofed, including plugging active water leaks.

1.2 RELATED REQUIREMENTS

A. Section 03300 - Cast-in-Place Concrete: Concrete work to be waterproofed.

B. Section 04810 - Unit Masonry Assemblies: Concrete masonry work to be waterproofed.

1.3 REFERENCE STANDARDS

A. COE CRD-C 48 - Standard Test Method for Water Permeability of Concrete; 1992.

1.4 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
1. Test data showing hydraulic permeability.
2. Preparation instructions and recommendations.
3. Storage and handling requirements and recommendations.
4. Installation methods.
5. Details for waterproofing at joints, intersections, and other special conditions.

C. Specimen warranty.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacture of products of the type specified and providing technical representatives to visit project site.

B. Installer Qualifications: Acceptable to manufacturer, with documented experience on at least 5 projects of similar nature within the last 5 years.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Take necessary precautions to keep cementitious materials dry.

1.7 FIELD CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.8 WARRANTY

A. See Section 01780 - Closeout Submittals, for additional warranty requirements.

B. Provide installer's warranty agreeing to correct leaking waterproofing for 2 years from the Date of Substantial Completion, unless leakage is caused by structural failure, movement of the structure, or other causes beyond the installer's control.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Crystalline Waterproofing:
1. Euclid Chemical Company: www.euclidchemical.com
2. Gemite Products Inc: www.gemite.com.
3. Vandex: www.vandex-usa.com.
4. Xypex Chemical Corporation: www.xypex.com.
5. Substitutions: See Section 01600 - Product Requirements.

2.2 APPLICATIONS

A. Waterproofing for building surfaces:
1. Inside of elevator pits.

B. Waterproofing for water holding structures:
1. Inside of swimming pools.
2. Surfaces indicated on drawings.

2.3 MATERIALS

A. Crystalline Waterproofing: Portland cement and chemical compound that when applied to the surface of concrete forms insoluble crystals in the capillary pores preventing the passage of liquids, while having no adverse effect on the normal properties of concrete.
1. Hydraulic Permeability: No measurable leakage or water flow at 200 psi pressure when tested in accordance with COE CRD-C 48, using minimum 2 inch thick sample and 20 days duration.
2. Toxicity: Non-toxic.
3. Color: Gray.

B. Plugging Compound: Cementitious compound meeting requirements specified for waterproofing, with additional characteristic of rapid set under water, recommended or approved by waterproofing manufacturer.

C. Patching Compound: Ready-mixed cementitious mortar recommended or approved by waterproofing manufacturer.

PART 3 - EXECUTION

3.1 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.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions. Use sand blasting, water blasting, or acid etching as recommended.

C. Plug water leaks.

D. Patch holes, construction joints, and cracks. Remove defective concrete.

E. Obtain approval of manufacturer's field representative before beginning installation.

3.3 INSTALLATION

A. Install in strict accordance with manufacturer's instructions. Maintain environmental conditions required and recommended by manufacturer. Keep a copy of manufacturer's instructions on site.

B. Coordinate installation with installation of products that must penetrate waterproofed surfaces.

C. Prevent excessive drying of surface.
1. Cure waterproofing for at least 3 days, or length of time required by manufacturer, with water spray and adequate air circulation.
2. Do not use chemical curing agents unless explicitly approved by waterproofing manufacturer.

D. Do not backfill, fill water or liquid holding structures, or apply finish coatings until time period recommended by manufacturer has passed.

3.4 FIELD QUALITY CONTROL

A. Flood test waterproofing application by filling water holding structures to capacity and allowing to stand for not less than 24 hours.

B. If any leaks appear, notify Architect and drain.
1. Repair leaks at no additional cost to Owner.
2. Repeat flood test until all leakage is eliminated.

3.5 PROTECTION

A. Protect from damage by weather. Do not cover with impermeable (plastic) sheeting unless air circulation is provided.

B. Touch-up, repair or replace damaged waterproofing after Substantial Completion.

END OF SECTION 07162

SECTION 07212 - BOARD AND BATT INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Board insulation and integral vapor retarder at exterior cavity wall construction.

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

C. Batt insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.

1.2 RELATED REQUIREMENTS

A. Section 01616 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 03450 - Architectural Precast Concrete.

C. Section 05400 - Cold Formed Metal Framing: Supporting construction for batt insulation.

D. Section 06100 - Rough Carpentry: Supporting construction for batt insulation.

E. Section 09260 - Gypsum Board Assemblies: Acoustic insulation.

1.3 REFERENCE STANDARDS

A. ASTM C 240 - Standard Test Methods of Testing Cellular Glass Insulation Block; 2008.

B. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation; 2007.

C. ASTM C 578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2009.

D. ASTM C 665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2006.

E. ASTM C 1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2008.

F. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2010.

G. ASTM E 136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace At 750 Degrees C; 2009b.

1.4 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

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

C. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.

1.5 FIELD CONDITIONS

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

PART 2 - PRODUCTS

2.1 APPLICATIONS

A. Insulation Inside Exterior Cavity Walls: Polyisocyanuate board.

B. Insulation in Metal Framed Walls: Batt insulation with integral vapor retarder.

C. Insulation Above Lay-In Acoustical Ceilings: Batt insulation with no vapor retarder.

2.2 FOAM BOARD INSULATION MATERIALS

A. Polyisocyanurate Board Insulation: Rigid cellular foam, complying with ASTM C 1289; Type I, aluminum foil both faces; Class 1, non-reinforced foam core.

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. Compressive Strength: 16 psi
4. Board Size: 48 x 96 inch.
5. Thermal Resistance: R-value of 19.
6. Board Edges: Square.
7. Manufacturers:
   a. Atlas Roofing Corporation: www.atlasroofing.com.
   b. Dow Chemical Co: www.dow.com.
   c. GAF Materials Corporation: www.gaf.com.
8. Substitutions: See Section 01600 - Product Requirements.

2.3 BATT INSULATION MATERIALS

A. Glass Fiber Batt Insulation: Flexible preformed batt or blanket, complying with ASTM C 665; friction fit.

1. Combustibility: Non-combustible, when tested in accordance with ASTM E136, except for facing, if any.
2. Thermal Resistance: R-26.
3. Facing: Aluminum foil, flame spread 25 rated; one side.
4. Manufacturers:
   a. CertainTeed Corporation: www.certainteed.com.
   b. Johns Manville Corporation: www.jm.com.
   c. Knauf Insulation GmbH: www.knaufinsulation.us.
   d. Owens Corning Corp: www.owenscorning.com.
5. Substitutions: See Section 01600 - Product Requirements.

2.4 ACCESSORIES

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

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

PART 3 - EXECUTION

3.1 EXAMINATION

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

B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

3.2 BOARD INSTALLATION AT EXTERIOR WALLS

A. Install boards horizontally on walls.
1. Place boards on push pins mounted to backside of precast wall panels.
2. Install in running bond pattern.
3. Butt edges and ends tightly to adjacent boards and to protrusions.

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

3.3 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 metal framing, place vapor retarder on warm side of insulation; 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.

END OF SECTION 07212

SECTION 07220 - SPRAYED INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Spray Polyurethane Foam (SPF).

1.2 RELATED SECTIONS

A. Section 05120 - Structural Steel: Insulating inside steel tube beams.

B. Section 05300 - Metal Deck: Substrate for insulation.

C. Section 07900 - Joint Sealers: Rod and sealant at control and expansion joints.

1.3 REFERENCES

A. ASTM C 518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

B. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

C. ASTM E 96 - Standard Test Methods for Water Vapor Transmission of Materials.

D. ASTM E 283 - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.

E. ASTM D 1621 - Standard Test Method for Compressive Properties Of Rigid Cellular Plastics.

F. ASTM D 1622 - Standard Test Method for Apparent Density of Rigid Cellular Plastics.

G. ASTM D 6226 - Standard Test Method for Open-Cell Content of Rigid Cellular Plastics.

H. AATCC 127 - Water Resistance: Hydrostatic Pressure Test.

1.4 PERFORMANCE REQUIREMENTS

A. Conform to applicable code for flame and smoke, concealment, and over coat requirements.

1.5 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

C. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing urethane foam products and systems of this section with minimum ten years documented experience.

B. Installer Qualifications: Company specializing in performing Work of this section with minimum three years documented experience.

1. Installer must be an NCFI Gold Star certified insulation contractor or have manufacturer's certification for the application.
2. Installer shall provide the equipment required by the manufacturer for proper installation including high pressure plural component proportioning pump, heated hoses of suitable length, spray gun, drum pumps or other material feeding system, and other ancillary equipment required for the Work.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store products under cover in manufacturer's unopened and labeled packaging until ready for installation.

B. Storage temperatures should not exceed 90 degrees F (32.22 degrees C). Do not store in direct sunlight.

C. Keep the temperature of the chemicals above 70 degrees F (21.66 degrees C) for several days prior to use. Cold chemicals can cause pump cavitation and incorrect metering. Keep drums tightly closed when not in use and under dry gas pressure of 2-3 psi after they have been opened.

D. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.8 PRE-INSTALLATION MEETINGS

A. Convene pre-installation meeting a minimum of two weeks prior to commencing work of this section.

B. Attendance: Architect, Contractor, framer, wall finish applicator and SPF applicator.

C. Agenda: Review installation sequence and scheduling.

1.9 COORDINATION

A. A. Ensure that the installation of products of this section are coordinated with affected trades to prevent interruption of construction progress.

1.10 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

B. Do not install spray polyurethane foam during precipitation or when precipitation is imminent. Do not install when the ambient temperature is less than 50 degrees F (10 degrees

C) without specific authorization of the manufacturer. Do not install when the ambient humidity exceeds the manufacturer's limits.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer:
1. NCFI Polyurethanes, Mount Airy Industrial Park P. O. Box 1528 ; Mount Airy, NC 27030-1528; Toll Free Tel: 800-346-8229; Tel: 336-789-9161; Web: www.insulquiet.com.
2. BASF Polyurethane Foam Enterprises LLC, 1703 Crosspoint Ave. Houston, TX 77054, Toll Free: 888-900-FOAM Phone: 713-796-9743 Fax: 713-383-4590, www.basf- pfe.com.
3. CertainTeed Corporation, P.O. Box 860, Valley Forge, PA 19482-0105, Phone: (610) 341- 7000, (800) 233-8990, Fax: (610) 341-7571, Website: www.certainteed.com.

B. Requests for substitutions will be considered in accordance with provisions of Section 01600.

2.2 PRODUCT

A. Basis-of-Design: NCFI's InsulStar closed cell polyurethane insulation.

2.3 MATERIALS

A. Spray Polyurethane Foam (SPF): High-performance, closed cell spray polyurethane foam (SPF) insulation:
1. Physical Properties:
a. Core Density: 1.8 to 2.0 lbs/ft3 when tested in accordance with ASTM D 1622.
b. Compressive Strength: 22 psi minimum when tested in accordance with ASTM D 1621.
c. Water Vapor Transmission: Less then or equal to 1.8 perms at 1 inch thick when tested in accordance with ASTM E 96.
d. Closed Cell content: Greater than 90 percent when tested in accordance with ASTM D 6226.
e. Maximum Service Temperature: 180 degrees F (82 degrees C).
f. Air Leakage: Infiltration/exfiltration, 0.004 CF/min/SF at 1.57 psf when tested in accordance with ASTM E 283.
g. Water Resistance: No Failure at greater than 40 foot Head Pressure when tested in accordance with AATCC 127.
h. Flame Spread: Less than 25 when tested in accordance with ASTM E 84 for 2 inch (51 mm) thickness.
i. Smoke Developed: Less than 450 when tested in accordance with ASTM E 84 for 2 inch (51 mm) thickness.
2. R-Value: R-Value when tested in accordance with ASTM C 518.
a. R-Value: 6.4. Average Thickness 1 inch (25 mm).

2.4 MISCELLANEOUS MATERIALS

A. Thermal Barrier: Equal to intumescent fire resistant coating, water based and with no VOCs, equal to Flame Seal - TB™ Thermal Barrier for Polyurethane Foam Insulation as manufactured by Specialty Products, Inc., 2410 - 104th St. Ct. S., Suite D, Lakewood, WA 98499, (800) 627-0773, (253) 588-7101.

1. Film Thickness: 25 wet mils (thermal barrier).

B. Joint Filler Foam: Hilti CF 124 Filler Foam or equivalent.

C. Sealant: Sikaflex 1a: Single component polyurethane or equivalent.

D. Foam Repair Kit: Handi-Foam two part kits from Fomo Products, or Touchn'Seal 2 component systems from Convenience Products, or other equivalent kits.

1. Moisture Detection Paper (MDP) Strips: MDP Strips manufactured by NCFI Polyurethanes, Mount Airy, NC.

PART 3 - EXECUTION

A. EXAMINATION

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

B. PREPARATION

1. Clean surfaces thoroughly prior to installation.
2. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
3. Proceed with spray polyurethane foam application only after substrate construction, substrate penetration work, and related electrical and plumbing work has been completed.
4. Remove sawdust and other debris from areas to be sprayed by blowing with compressed air or vacuuming with a shop vacuum.
5. All metal to which foam is to be applied must be free of oil, grease, rust, etc. Primers should be used where necessary.
6. Verify that substrate is dry by checking surface for moisture with Moisture Detection Paper (MDP) strips.
7. Fill voids between masonry and structural, steel greater than 2 inches (51 mm), with mineral wool or a backer gypsum board cut to fit in the void, and then spray over the backer material.
8. Mask off all areas not to receive spray foam with masking tape and plastic sheeting. Apply release agent to stud facing to facilitate removal of foam.
9. At the start of work, spray-apply SPF to an area of approximately 100 sf (9.29 sm) at the specified thickness. Proceed with work only after ensuring proper foam thickness and full adhesion to the substrate.

C. INSTALLATION

1. Install in accordance with manufacturer's instructions.
2. All surfaces to be sprayed with SPF must be free of all moisture and ice.
3. Do not apply SPF during inclement weather or when ambient temperature and humidity are outside the ranges prescribed by the manufacturer.
4. Apply the SPF to an average thickness of 2" unless otherwise indicated on the Drawings.

5. Apply SPF using a "picture framing" technique: apply a cant of foam between the substrate and the structure/framing. Then spray apply the required thickness of foam against the substrate. Apply the foam in 1-1/2 inches or less for each pass, using multiple passes to achieve the desired thickness.
6. Do not apply SPF to fill voids around doors and windows. Use non-expanding foam for those applications.
7. Apply SPF to fill voids around accessible service and equipment penetrations.
8. Apply SPF to seal voids at truss ends to prevent wind scouring of ceiling insulation.
9. Seal plumbing stacks, electrical wiring and other penetrations into attic to control air leakage.
10. Remove overspray from adjacent surfaces.
11. At steel tube beams, predrill holes where indicated or as acceptable to steel designer, Insert spray nozzle into holes and completely fill inside void in steel member. Ensure that void is 100% filled by drilling air relief holes where needed.
12. Where damage occurs which violates the spray foam's air seal and moisture seal, repair as needed using the specified spray polyurethane material or the specified foam repair kit material.

D. ACCESSORY APPLICATION
1. After overspray and damaged areas are corrected, apply thermal barrier coating with airless spray equipment, brush or roller, in strict accordance with manufacturer's written instruction.
2. Joint Filler Foam and Caulk: Use joint filler foam and/or caulk to seal around windows, doors, chimneys, electrical raceways, sill plates, multiple studs, etc. Note that the expansion of joint filler foam in a confined space can tighten window frames and door jambs to the point that they will not open or close properly. Care must be used in these areas to avoid distortion of these members.

E. PROTECTION
1. Protect installed products until completion of project.
2. Touch-up, repair or replace damaged products before Substantial Completion.

F. CLEANING
1. Remove excess SPF.
2. Replace defective SPF.
3. Clean soiled surfaces with cleaning solution.

END OF SECTION 07220

SECTION 07311 - ASPHALT SHINGLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Asphalt shingles.
   2. Self-adhering sheet underlayment.

B. Related Sections include the following:
   1. Division 6 Section "Rough Carpentry" for roof deck plywood and composite roofing panels.
   2. Division 7 Section "Sheet Metal Flashing and Trim" for copper louvered dormers and metal roof penetration flashings, step flashing, and counterflashings not part of this Section.

1.3 DEFINITIONS

A. Roofing Terminology: Refer to ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definitions of terms related to roofing work in this Section.

1.4 SUBMITTALS

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

B. Samples for Initial Selection: For each type of asphalt shingle and ridge and hip cap shingles indicated.
   1. Include similar Samples of trim and accessories involving color selection.

C. Samples for Verification: For the following products, of sizes indicated, to verify color selected.
   1. Asphalt Shingle: Full-size asphalt shingle strip.
   2. Ridge and Hip Cap Shingles: Full-size ridge and hip cap asphalt shingle.
   3. Self-Adhering Underlayment: 12 inches square.

D. Qualification Data: For Installer, including certificate signed by asphalt shingle manufacturer stating that Installer is approved, authorized, or licensed to install roofing system indicated.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for asphalt shingles.

F. Research/Evaluation Reports: For asphalt shingles.

G. Maintenance Data: For asphalt shingles to include in maintenance manuals.

H. Warranties: Special warranties specified in this Section.

I. QUALITY ASSURANCE

1. Installer Qualifications: A firm or individual that is approved, authorized, or licensed by asphalt shingle roofing system manufacturer to install roofing system indicated.

2. Source Limitations: Obtain ridge and hip cap shingles and self-adhering sheet underlayment through one source from a single asphalt shingle manufacturer.

3. Fire-Test-Response Characteristics: Provide asphalt shingle and related roofing materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

a. Exterior Fire-Test Exposure: Class A; ASTM E 108 or UL 790, for application and roof slopes indicated.

b. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store roofing materials in a dry, well-ventilated, weathertight location according to asphalt shingle manufacturer's written instructions. Store underlayment rolls on end on pallets or other raised surfaces. Do not double-stack rolls.

1. Handle, store, and place roofing materials in a manner to avoid significant or permanent damage to roof deck or structural supporting members.

B. Protect unused underlayment from weather, sunlight, and moisture when left overnight or when roofing work is not in progress.

1.6 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit asphalt shingle roofing to be performed according to manufacturer's written instructions and warranty requirements.

1. Install self-adhering sheet underlayment within the range of ambient and substrate temperatures recommended by manufacturer.

1.7 WARRANTY

A. Special Project Roof Warranty: Submit two executed copies of 5-year "Roofing Warranty" on form included at end of this section, covering work of this section including metal roof system, valleys, flashings, gutters and downspouts, scuppers, conductor heads, trim and roof accessories, signed and countersigned by Installer (Roofer) and Contractor. The Laws of the State of Alabama shall govern this warranty.

B. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace asphalt shingles that fail in materials or workmanship within specified warranty period. Materials failures include manufacturing defects and failure of asphalt shingles to self- seal after a reasonable time.

C. Verify available prorated and nonprorated warranty periods for asphalt shingles with manufacturers and insert numbers below.

1. Material Warranty Period: 40 years from date of Substantial Completion, prorated, with first 12 years nonprorated.
2. Wind-Speed Warranty Period: Asphalt shingles will resist blow-off or damage caused by wind speeds up to 100 mph for 10 years from date of Substantial Completion.
3. Algae-Discoloration Warranty Period: Asphalt shingles will not discolor five years from date of Substantial Completion.
4. Workmanship Warranty Period: 12 years from date of Substantial Completion.
5. Special Project Warranty: Roofing Installer's warranty, on warranty form at end of this Section, signed by roofing Installer, covering Work of this Section, in which roofingInstaller agrees to repair or replace components of asphalt shingle roofing that fail in materials or workmanship within the following warranty period:
   a. Warranty Period: Five years from date of Substantial Completion.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Asphalt Shingles: 100 sq. ft of each type, in unbroken bundles.

PART 2 - PRODUCTS

2.1 GLASS-FIBER-REINFORCED ASPHALT SHINGLES

A. Basic product descriptions in this Article correspond to types recognized in ARMA's "Residential Asphalt Roofing Manual." Edit to suit Project; delete types not required. Refer to tables at end of the Evaluations for a list of manufacturers' products. Use these tables in combination with manufacturers' catalogs or product data to insert series, types, and designations of asphalt shingles.

1. Laminated-Strip SBS- or APP- Modified Asphalt Shingles: ASTM D 3462, laminated, multi-ply overlay construction, glass-fiber reinforced, mineral-granule surfaced, and self-sealing; complying with UL 2218, Class IV.
   a. Available Products:
      1) Atlas Roofing Corporation
      2) IKO
      3) Malarkey Roofing Company
   b. Butt Edge: Straight cut.
   c. Strip Size: Manufacturer's standard.
   d. Algae Resistance: Granules treated to resist algae discoloration.
   e. Color and Blends: As selected by Architect from manufacturer's full range.
2. Hip and Ridge Shingles: Manufacturer's standard units to match asphalt shingles.
3. Vented Ridge Cap: Provide vented ridge cap designed for roof and shingles indicated. Ridge cap shall be equal to Vent-Sure Rigid Vent by Owens-Corning. Locate continuously along entire ridge line of shingle roof(s), stopping 10 feet from edge of roof.

2.2 ROOF INSULATION

A. General: Provide preformed roof insulation boards that comply with requirements and referenced standards, selected from manufacturer's standard sizes and of thicknesses indicated.

B. Composite Polyisocyanurate Board Insulation: ASTM C 1289, faced with insulation board on one major surface, as indicated below by type, and felt or glass-fiber mat facer on the other.

1. Manufacturers:
   a. Atlas Roofing Corporation.
   b. Celotex Corporation.
   c. Firestone Building Products Company.
   d. GAF Materials Corp.
   e. GenFlex Roofing Systems.
   f. Johns Manville International, Inc.
   g. Koppers Industries.
   h. RMAX.Hunter Panels (Composite Board Insulation),
      1) R-Value: Aged "R" value of 30 minimum.
      2) Type V, Vented with 1” Wood Spacers, Oriented Strand Board Facer, 7/16 inch thick. Insulation board must be layered in order to meet R-Value requirement.

C. Insulation Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.

2.3 UNDERLAYMENT MATERIALS

A. Underlayment: Equal to W. R. Grace “Ultra” a self-adhering sheet membrane for use in high temperatures shall be installed under all asphalt shingle roof applications, and installed per manufacturer's recommendation.

B. Sealant: Sealant must be ultra low modulus, high performance, one-part, moisture curing silicone joint sealant. Do not use a clear sealant or sealants which release a solvent or acid during curing. Sealant must be resistant to environmental conditions such as wind loading, wind driven rain, snow, sleet, acid rain, ozone, ultraviolet light and extreme temperature variations.

1. Features must include joint movement capabilities of +100% & -50% ASTM C-719, capable of taking expansion, compression, transverse and longitudinal movement, service temperature range -65ºF to 300ºF, Flow, sag or slump: ASTM C-639; Nil, Hardness (Shore A): ASTM C-661; 15, Tensile strength at maximum elongation: ASTM D-412; 200 psi, Tensile strength at 100% elongation: ASTM D-412; 35 psi, Tear strength, (die “C”); ASTM D-624; 40 pli, Peel strength (Aluminum, Glass, Concrete): ASTM C-794.

2.4 ACCESSORIES

A. Asphalt Roofing Cement: ASTM D 4586, Type II, asbestos free.

B. NRCA recommends barbed- or deformed-shank nails for added pull-out resistance. ARMA recommends smooth-shank nails and allows barbed or deformed nails. Some asphalt shingle manufacturers recommend barbed or deformed nails.

C. Roofing Nails: ASTM F 1667; aluminum, stainless-steel, or copper wire shingle nails, minimum 0.120-inch- diameter, barbed shank, sharp-pointed, with a minimum 3/8-inch- diameter flat head and of sufficient length to penetrate 3/4 inch into solid wood decking or extend at least 1/8 inch through OSB or plywood sheathing.

1. Where nails are in contact with metal flashing, use nails made from same metal as flashing.

2.5 METAL FLASHING AND TRIM

A. Sheet Metal Flashing and Trim: Comply with requirements in Division 7 Section "Sheet Metal Flashing and Trim."

B. Fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item.

1. Apron Flashings: Fabricate with lower flange a minimum of 5 inches over and 4 inches beyond each side of downslope asphalt shingles and 6 inches up the vertical surface.
2. Step Flashings: Fabricate with a headlap of 2 inches and a minimum extension of 5 inches over the underlying asphalt shingle and up the vertical surface.
3. Cricket or Backer Flashings: Fabricate with concealed flange extending a minimum of 18 inches to 24 inches beneath upslope asphalt shingles and 6 inches beyond each side and 6 inches above the roof plane.
4. Open Valley Flashings: Fabricate in lengths not exceeding 10 feet with 1-inch- high inverted-V profile at center of valley and equal flange widths of 12 inches.
5. Drip Edges: Fabricate in lengths not exceeding 10 feet with 2-inch roof deck flange and 4- inch fascia flange with 1/2-inch hemmed drip at lower edge.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

1. Examine roof sheathing to verify that sheathing joints are supported by framing and blocking or metal clips and that installation is within flatness tolerances.
2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and completely anchored; and that provision has been made for flashings and penetrations through asphalt shingles.
3. Delete subparagraph below if not required.
4. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.

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

3.2 UNDERLAYMENT INSTALLATION

A. Single-Layer Felt Underlayment: Install single layer of felt underlayment on roof deck perpendicular to roof slope in parallel courses. Lap sides a minimum of 2 inches over underlying course. Lap ends a minimum of 4 inches. Stagger end laps between succeeding courses at least 72 inches. Fasten with roofing nails.

1. Install felt underlayment on the primary field of roof deck not covered by self-adhering sheet underlayment. Lap sides of felt over self-adhering sheet underlayment not less than 3 inches in direction to shed water. Lap ends of felt not less than 6 inches over self- adhering sheet underlayment.

B. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free, on roof deck. Comply with low-temperature installation restrictions of underlayment manufacturer if applicable. Install at all shingle loactions, lapped in direction to shed water. Lap sides not less than 3-

1/2 inches. Lap ends not less than 6 inches staggered 24 inches between courses. Roll laps with roller. Cover underlayment within seven days.

3.3 METAL FLASHING INSTALLATION

A. General: Install metal flashings and other sheet metal to comply with requirements in Division 7 Section "Sheet Metal Flashing and Trim."

1. Install metal flashings according to recommendations in ARMA's "Residential Asphalt Roofing Manual" and asphalt shingle recommendations in NRCA's "The NRCA Roofing and Waterproofing Manual."

B. Apron Flashings: Extend lower flange over and beyond each side of downslope asphalt shingles and up the vertical surface.

C. Step Flashings: Install with a headlap of 2 inches and extend over the underlying asphalt shingle and up the vertical surface. Fasten to roof deck only.

D. Cricket or Backer Flashings: Install against the roof-penetrating element extending concealed flange beneath upslope asphalt shingles and beyond each side.

E. Open Valley Flashings: Install centrally in valleys, lapping ends at least 8 inches in direction to shed water. Fasten upper end of each length to roof deck beneath overlap.

1. Secure hemmed flange edges into metal cleats spaced a maximum of 12 inches apart, or as required to achieve wind-rating requirements, and fastened to roof deck.
2. Adhere 9-inch- wide strip of self-adhering sheet to metal flanges and to self-adhering sheet underlayment.

F. Rake Drip Edges: Install rake drip edge flashings over underlayment and fasten to roof deck.

G. Eave Drip Edges: Install eave drip edge flashings below underlayment and fasten to roof sheathing.

H. Pipe Flashings: Form flashing around pipe penetrations and asphalt shingles. Fasten and seal to asphalt shingles as recommended by manufacturer.

3.4 ASPHALT SHINGLE INSTALLATION

A. Install asphalt shingles according to manufacturer's written instructions, recommendations in ARMA's "Residential Asphalt Roofing Manual," and asphalt shingle recommendations in NRCA's "The NRCA Roofing and Waterproofing Manual."

B. Install starter strip along lowest roof edge, consisting of an asphalt shingle strip at least 7 inches wide with self-sealing strip face up at roof edge.

1. Extend asphalt shingles 3/4 inch over fascia at eaves and rakes.
2. Install starter strip along rake edge.

C. Install first and remaining courses of asphalt shingles stair-stepping diagonally across roof deck with manufacturer's recommended offset pattern at succeeding courses, maintaining uniform exposure.

D. Basic fastening for most asphalt shingles requires four roofing nails; some asphalt shingles require five. Building codes may require a minimum of six roofing nails for areas subject to high wind speeds.

E. Fasten asphalt shingle strips according to manufacturer's written instructions for wind- resistance rating indicated.

F. Open Valleys: Cut and fit asphalt shingles at open valleys, trimming upper concealed corners of shingle strips. Maintain uniform width of exposed open valley from highest to lowest point.

1. Set valley edge of asphalt shingles in a 3-inch- wide bed of asphalt roofing cement.
2. Do not nail asphalt shingles to metal open valley flashings.

G. Ridge and Hip Cap Shingles: Maintain same exposure of cap shingles as roofing shingle exposure. Lap cap shingles at ridges to shed water away from direction of prevailing winds. Fasten with roofing nails of sufficient length to penetrate sheathing.

END OF SECTION 07311

SECTION 07411 - PREFORMED METAL ROOF PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Preformed, pre-finished metal roofing and flashings.

B. Miscellaneous trim, flashing, closures, drip flashing, and accessories.

C. Composite board roof insulation.

D. Fastening devices.

1.3 RELATED SECTIONS

A. Section 01230: Alternates

B. Section 05310: Steel Decking.

C. Section 06100: Rough Carpentry.

D. Section 07620: Sheet Metal Flashing.

E. Section 07900: Sealants.

1.4 REFERENCES

A. American Iron & Steel Institute (AISI) Specification for the Design of Cold formed Steel Structural Members.

B. ASTM A-525 Steel Sheet, Zinc-Coated (Galvanized)

C. ASTM E-1680

D. ASTM E-1646

E. ASTM E-1592

F. SMACNA - Architectural Sheet Metal Manual.

G. Building Materials Directory - Underwriter's Laboratories, Test Procedure 580.

1.5 ASSEMBLY DESCRIPTION

A. The roofing assembly includes preformed sheet metal panels, related accessories, valleys, hips, ridges, eaves, corners, rakes, miscellaneous flashing and attaching devices.

1.6 SUBMITTALS

A. Submit detailed drawings showing layout of panels, anchoring details, joint details, trim, flashing, and accessories. Show details of weatherproofing, terminations, and penetrations of metal work.

B. Submit a sample of each type of roof panel, complete with factory finish.

C. Submit results indicating compliance with minimum requirements of the following performance tests:

1. Air Infiltration - ASTM E 1680
2. Water Infiltration - ASTM E 1646
3. Wind Uplift - U.L.90
    a. Submit calculations with registered engineer seal, verifying roof panel and attachment method resists wind pressures imposed on it pursuant to applicable building codes.

1.7 QUALITY ASSURANCE

A. Manufacturer: Company specializing in Architectural Sheet Metal Products with ten (10) years minimum experience.

B. No product substitutions shall be permitted without meeting specifications.

C. Substitutions shall be submitted 10 Days prior to Bid Date and acceptance put forth in an addendum.

D. No substitutions shall be made after the Bid Date.

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

1.8 DELIVERY, STORAGE AND HANDLING

A. Upon receipt of panels and other materials, installer shall examine the shipment for damage and completeness.

B. Panels should be stored in a clean, dry place. One end should be elevated to allow moisture to run off.

C. Panels with strippable film must not be stored in the open, exposed to the sun.

D. Stack all materials to prevent damage and to allow for adequate ventilation.

1.9 WARRANTY

A. Paint finish shall have a twenty year guarantee against cracking, peeling and fade (not to exceed 5 N.B.S. units).

B. Special Project Roof Warranty: Submit two executed copies of 5-year "Roofing Warranty" on form included at end of this section, covering work of this section including metal roof system, valleys, flashings, gutters and downspouts, scuppers, conductor heads, trim and roof accessories, signed and countersigned by Installer (Roofer) and Contractor. The Laws of the State of Alabama shall govern this warranty.

C. Special Weathertightness Warranty: The entire installation shall be guaranteed weathertight for the specified warranty period. Provide written warranty, signed by metal roofing manufacturer and his authorized installer agreeing to replace/repair defective materials and workmanship during the warranty period.

1. Weathertight Warranty Period: 10 years from date of Substantial Completion.

Weathertight warranty shall be based on the following requirements:

a. A roof system engineered/designed so all components work together to function as a single metal roof membrane, expanding and contracting with thermal movement.

b. Manufacturer approved installers trained to install the roof per the manufacturer's guidelines.

c. Complete and easy to interpret installation details/guidelines.

d. Inspections of the roof installation during and after completion by an independent, third-party inspection group.

PART 2 - PRODUCT

2.1 ACCEPTABLE MANUFACTURERS

A. ACI Building Systems, 10125 Highway 6 West, Batesville, MS38606.

B. Metal Sales Manufacturing Corp.,545 South 3rd Street, Louisville, KY40202.

C. Berridge Manufacturing Company, Houston, Texas or equal products by Architectural Building Components, ATAS International, Inc., AEP Span or Petersen Aluminum Corp.

D. Substitutions shall fully comply with specified requirements.

2.2 SHEET MATERIALS

A. Pre-finished Metal shall be Hot-Dipped Galvanized - ASTM A653-94 Grade C G90 Coating A924-94 24 Gauge core steel.

B. Unfinished Metal shall be Grade C Aluminum Zinc Alloy Coated Steel ASTM 792-86, AZ 55, "Satin Finish".

C. Finish shall be full strength Kynar 500 coating, applied by the manufacturer on a continuous coil coating line, with a top side dry film thickness of 0.70 to 0.90 mil over 0.25 to 0.35 mil prime coat, to provide a total dry film thickness of 0.95 to 1.25 mil. Bottom side shall be coated with primer with a dry film thickness of 0.25 mil. Finish shall conform to all tests for adhesion, flexibility, and longevity as specified by the Kynar 500 finish supplier.

D. Strippable film shall be applied to the top side of the painted coil to protect the finish during fabrication, shipping and field handling. This strippable film must be removed immediately before installation.

2.3 ROOF INSULATION

A. General: Provide preformed roof insulation boards that comply with requirements and referenced standards, selected from manufacturer's standard sizes and of thicknesses indicated.

B. Composite Polyisocyanurate Board Insulation: ASTM C 1289, faced with insulation board on one major surface, as indicated below by type, and felt or glass-fiber mat facer on the other.

1. Manufacturers:
   a. Atlas Roofing Corporation.
   b. Celotex Corporation.
   c. Firestone Building Products Company.
   d. GAF Materials Corp.
   e. GenFlex Roofing Systems.
   f. Johns Manville International, Inc.
   g. Koppers Industries.
   h. RMAX.
      1) R-Value: Aged "R" value of 30 minimum.
      2) Type V (oriented-strand-board facer), 7/16 inch thick.

C. Insulation Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.

2.4 ACCESSORY MATERIALS

A. Fasteners: Cadmium Plated Steel with washers where required.

B. Underlayment: W. R. Grace “Ultra” a self-adhering sheet membrane for use in high temperatures shall be installed under all metal roof applications, and installed per manufacturer's recommendation.

C. Sealant: Sealant must be ultra low modulus, high performance, one-part, moisture curing silicone joint sealant. Do not use a clear sealant or sealants which release a solvent or acid during curing. Sealant must be resistant to environmental conditions such as wind loading, wind driven rain, snow, sleet, acid rain, ozone, ultraviolet light and extreme temperature variations.

1. Features must include joint movement capabilities of +100% & -50% ASTM C-719, capable of taking expansion, compression, transverse and longitudinal movement, service temperature range -65ºF to 300ºF, Flow, sag or slump: ASTM C-639; Nil, Hardness (Shore A): ASTM C-661; 15, Tensile strength at maximum elongation: ASTM D-412; 200 psi, Tensile strength at 100% elongation: ASTM D-412; 35 psi, Tear strength, (die “C”); ASTM D-624; 40 pli, Peel strength (Aluminum, Glass, Concrete): ASTM C-794.

D. Vinyl Weatherseal Insert: Extruded vinyl strip to be integral part of snap-on seams.

2.5 FABRICATION

A. All exposed adjacent flashing shall be of the same material and finish as the roof panels.

B. Hem all exposed edges of flashing on underside, 1/2 inch.

2.6 PREFORMED METAL PANELS - BASIS OF DESIGN

A. Berridge ZEE-LOCK Standing Seam Panel
   1. 2" high vertical legs shall be spaced at 16" on-center.
   2. Panels shall be site-formed with the Berridge Model SP-21x in tandem with the ZC-21 Portable Roll Former in continuous lengths.

3. Continuous Zee Rib shall be 1-3/8" wide and 2-1/8" in height. Rib shall be connected to Zee Clips spaced at 3'-0" on solid substraight.
4. Vinyl Weatherseal or compatible sealant to be factory-installed over Continuous Zee Rib.
5. Sidelap to be mechanically seamed with a powered seamer.
6. Panel assembly to bear Underwriters Laboratories Label UL90, pursuant to Construction Number 403 over solid substrate and applicable Fire Ratings.
7. Certification shall be submitted, based on independent testing laboratory, indicating no measurable water penetration or air leakage through the system when tested in accordance with ASTM E-1680-95 and ASTM E-1646-95.

PART 3 - EXECUTION

3.1 INSPECTION

A. Substrate:
1. Inspect roof deck to verify deck is clean and smooth, free of depressions, waves or projections, level to ¼" in 20', and properly sloped to valleys or eaves.
2. Verify roof openings, curbs, pipes, sleeves, ducts or vents through roof are solidly set, cant strips and reglets in place, and nailing strips located.

3.2 UNDERLAYMENT

A. W.R. Grace "Ultra" underlayment to be used on all metal roof applications. Follow manufacturer's recommendations for proper installation.

3.3 INSULATION INSTALLATION

A. Coordinate installing membrane roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with roofing system manufacturer's written instructions for installing roof insulation.

C. Install one or more layers of insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2 inches or greater, install 2 or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches (150 mm) in each direction.

D. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch (6 mm) with insulation.
1. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.

E. Mechanically Fastened Insulation: Install each layer of insulation and secure to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.
1. Fasten insulation according to requirements in FMG's "Approval Guide" for specified Windstorm Resistance Classification.
2. Fasten insulation to resist uplift pressure at corners, perimeter, and field of roof.

F. Underlayment:
1. Verify that ice & water shield underlayment has been installed over plywood deck and fastened in place.
2. Ensure underlayment installed horizontally, starting at eave to ridge with a 6" minimum overlap and 18" end laps.
3. Ensure that all screw heads are totally flush with the substrate.

3.4 ROOFING INSTALLATION

A. Comply with manufacturers standard instructions and conform to standards set forth in the Architectural Sheet Metal Manual published by SMACNA, in order to achieve a watertight installation.

B. Install panels in such a manner that horizontal lines are true and level and vertical lines are plumb.

C. Install starter and edge trim before installing roof panels.

D. Remove protective strippable film prior to installation of roof panels.

E. Attach panels using manufacturer's standard clips and fasteners, spaced in accordance with approved shop drawings.

F. Install sealants for preformed roofing panels as approved on shop drawings.

G. Do not allow panels or trim to come into contact with dissimilar materials.

H. Do not allow traffic on completed roof. If required, provide cushioned walk boards.

I. Protect installed roof panels and trim from damage caused by adjacent construction until completion of installation.

J. Remove and replace any panels or components which are damaged beyond successful repair.

3.5 CLEANING

A. Clean any grease, finger marks or stains from the panels per manufacturer's recommendations.

B. Remove all scrap and construction debris from the site.

3.6 FINAL INSPECTION

A. Final inspection will be performed by a third-party roofing consulting company recommended by the roofing manufacturer. All required corrective work shall be properly executed by the roofer and re-reviewed by testing company for compliance and warranty assurance.

END OF SECTION 07411

SECTION 07421 - METAL WALL PANELS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Concealed fastener metal wall panels as part of the assembly described below.
   1. Metal Wall Panels: Single-skin concealed fastener metal wall panels applied as the exterior cladding over wall framing specified in Division 05 Section "Cold-Formed Metal Framing" with exterior sheathing. Metal wall panel installation specified in this Section includes secondary metal sub-framing for panel attachment.
      a. Water-resistive barrier is provided under Division 07 Section "Weather Barriers."

B. Exposed fastener metal wall panels with overlapping side edges.

1.2 RELATED REQUIREMENTS

A. Division 01 Section "Sustainable Design Requirements" for related LEED general requirements.

B. Division 07 Section "Sheet Metal Flashing and Trim" for sheet metal copings, flashings, reglets and roof drainage items.

C. Division 07 Section "Joint Sealants" for field-applied joint sealants.

1.3 REFERENCES

A. American Architectural Manufacturer's Association (AAMA):
   1. AAMA 501.1 - Test Method for Water Penetration of Windows, Curtain Walls and Doors Using Dynamic Pressure.
   2. AAMA 620 - Voluntary Specification for High Performance Organic Coatings on Coil
   3. AAMA 621 - Voluntary Specification for High Performance Organic Coatings on Coil Coated Architectural Hot Dipped Galvanized (HDG) and Zinc-Aluminum Coated Steel Substrates.

B. American Society of Civil Engineers (ASCE):
   1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.

C. ASTM International (ASTM):
   1. ASTM A 653/A 653M - Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   2. ASTM A 755/A 755M - Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.
   3. ASTM B 209 - Specification for Aluminum and Aluminum Alloy Sheet and Plate.
   4. ASTM C 754 - Specification for Installation of Steel Framing Members to Receive Screw Attached Gypsum Panel Products.
   5. ASTM C 920 - Specification for Elastomeric Joint Sealants.
   6. ASTM C 1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories.
   7. ASTM E 72 - Standard Test Methods of Conducting Strength Tests of Panels for Building Construction.

8. ASTM E 283 - Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors under Specified Pressure Differences across the Specimen.
9. ASTM E 331 - Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.

D. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA):
1. Architectural Sheet Metal Manual.

1.4 PERFORMANCE REQUIREMENTS

A. General: Provide metal wall panel assemblies meeting performance requirements as determined by application of specified tests by a qualified testing agency on manufacturer's standard assemblies.

B. Air Infiltration: Maximum 0.06 cfm/sq. ft. (0.3 L/s per sq. m) per ASTM E 283 at a static-air pressure difference of 1.57 lbf/sq. ft. (75 Pa), using minimum 10-by-10 foot (3050-by-3050 mm) test panel that includes side joints.

C. Water Penetration, Static Pressure: No uncontrolled water penetration per ASTM E 331 at a minimum static differential pressure of 6.24 lbf/sq. ft. (299 Pa), using minimum 10-by-10 foot (3050-by-3050 mm) test panel that includes side joints.

D. Structural Performance: Provide metal wall panel assemblies capable of withstanding the effects of indicated loads and stresses within limits and under conditions indicated, per ASTM E 72:
1. Wind Loads: Determine loads based on uniform pressure, importance factor, exposure category, and basic wind speed indicated on drawings.
2. Limits of Deflection: Metal wall panel assembly shall withstand scheduled wind pressure with the following allowable deflection:
a. Maximum allowable deflection limited to L/180 deflection of panel perimeter normal to plane of wall with no evidence of failure.
3. Secondary Metal Framing: Design secondary metal framing for metal wall panel assembly according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions."

E. Thermal Movements: Allow for thermal movements from variations in both ambient and internal temperatures. Accommodate movement of support structure caused by thermal expansion and contraction.

1.5 QUALITY ASSURANCE

A. Manufacturer/Source: Provide metal wall panel and panel accessories from a single manufacturer.

B. Manufacturer Qualifications: Approved manufacturer listed in this Section with minimum 10 years' experience in manufacture of similar products in successful use in similar applications.
1. Approval of Comparable Products: Submit the following in accordance with project substitution requirements, within time allowed for substitution review:
a. Product data, including certified independent test data indicating compliance with requirements.
b. Sample submittal from similar project.
c. Project references: Minimum of 5 installations not less than 5 years old, with Owner and Architect contact information.
d. Sample warranty.

2. Substitutions following award of contract are not allowed except as stipulated in Division 01 General Requirements.
3. Approved manufacturers must meet separate requirements of Submittals Article.

C. Installer Qualifications: Experienced Installer with minimum of 5 years experience with successfully completed projects of a similar nature and scope.

1.6 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct preinstallation meeting at site attended by Owner, Architect, manufacturer's representative, and other trade contractors.
1. Coordinate building framing in relation to metal wall panel assembly.
2. Coordinate installation of building air and water barrier behind metal wall panel assembly.
3. Coordinate window, door and louver, and other openings and penetrations of metal wall panel assembly.

1.7 ACTION SUBMITTALS

A. Product Data: Manufacturer's data sheets, for specified products.
1. Include data indicating compliance with performance requirements.

B. LEED Submittals:
1. Credit MR 4: Product data indicating the following:
a. Percentages by weight of post-consumer and pre-consumer recycled content.
b. Total weight of products provided.

C. Shop Drawings: Provide shop drawings prepared by manufacturer or manufacturer's authorized Installer. Include full elevations showing openings and penetrations. Include details of each condition of installation and attachment. Provide details at a minimum scale 1- 1/2-inch per foot (1:8) of all required trim and extrusions needed for a complete installation.
1. Indicate points of supporting structure that must coordinate with metal wall panel assembly installation.

D. Samples for Initial Selection: For each product specified. Provide representative color charts of manufacturer's full range of colors.

E. Samples for Verification: Provide 12-inch (300 mm) section of panel(s) showing finishes. Provide 12-inch (300 mm) long pieces of trim pieces and other exposed components.

F. Product Test Reports: Indicating compliance of products with requirements, from a qualified independent testing agency.

G. Qualification Information: For Installer firm.

H. Manufacturer's warranty: Submit sample warranty.

1.8 DELIVERY, STORAGE, AND HANDLING

A. A. Protect metal wall panel products during shipping, handling, and storage to prevent staining, denting, deterioration of components or other damage.

1. Deliver, unload, store, and erect metal wall panel products and accessory items without misshaping panels or exposing panels to surface damage from weather or construction operations.

1.9 WARRANTY

A. Special Manufacturer's Warranty: On manufacturer's standard form, in which manufacturer agrees to repair or replace components of metal wall panel assemblies that fail in materials and workmanship within two years from date of Substantial Completion.

B. Special Panel Finish Warranty: On manufacturer's standard form, in which manufacturer agrees to repair or replace metal wall panels that evidence deterioration of finish within the following periods from the date of substantial completion:

1. Warranty Period: 20 years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Berridge Manufacturing Co., 6515 Fratt Road, San Antonio, TX78218.

B. Basis of Design (Concealed Fastener): CENTRIA, IW Series Metal Wall Panels. Provide basis of design product, or comparable product approved by Architect prior to bid.

1. CENTRIA Architectural Systems; Moon Township, PA 15108-2944. Tel: (800)759-7474. Tel: (412) 299-8000. Fax: (412) 299-8317. Email: info@CENTRIA.com. Web: www.CENTRIA.com.
2. METAL WALL PANEL MATERIALS

C. Metallic-Coated Steel Face Sheet: Coil-coated, ASTM A 755/A 755M.

1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Class Z275), structural steel quality.
2. Aluminum-zinc alloy-coated Steel Sheet: ASTM A 792/A 792 M, Class AZ50 Grade 50 (Class AZM150, Grade 275), structural steel quality.

D. Face Sheet: 0.036 inch/20 gage (0.91 mm).

E. Surface: Non-Directional Embossed.

2.2 CONCEALED FASTENER METAL WALL PANELS

A. Metal Wall Panels, General: Factory-formed, concealed fastener panels with interconnecting side joints, fastened to supports with concealed fasteners, with factory-applied sealant in side laps when required to meet performance requirements.

B. Flush-joint profile with raised flat pan:

1. Basis of Design Product: CENTRIA, IW-10A.
2. Panel Coverage: 12 inches (305 mm).
3. Panel Height: 1.50 inches (38 mm).

2.3 METAL WALL PANEL ACCESSORIES

A. Metal Wall Panel Accessories, General: Provide complete metal wall panel assembly incorporating trim, copings, fasciae, parapet caps, soffits, sills, inside and outside corners, and miscellaneous flashings. Provide manufacturer's factory-formed shims, flashings, gaskets, lap strips, closure strips, and caps for a complete installation. Fabricate accessories in accordance with SMACNA Manual.

B. Extruded Trim: Manufacturer's complementary aluminum extrusions for head, jamb, sill, base, flush, reveal, inside and outside corner, endwall, and expansion joint details. Finish to match metal wall panels.

1. Basis of Design: CENTRIA, Microline Extrusions.

C. Mitered Corners: Structurally-bonded horizontal interior and exterior trimless corners matching metal wall panel material, profile, and factory-applied finish, fabricated and finished by metal wall panel manufacturer.

1. Welded, riveted, fastened, or field- fabricated corners do not meet the requirements of this specification.
2. Basis of Design: CENTRIA, MicroSeam Corners.

D. Formed Flashing and Trim: Match material, thickness, and color of metal wall panels.

E. Sealants: Type recommended by metal wall panel manufacturer for application, meeting requirements of Division 07 Section "Joint Sealants."

F. Flashing Tape: 4-inch wide self-adhering butyl flashing tape.

G. Fasteners: Self-tapping screws and other acceptable fasteners recommended by panel manufacturer. Where exposed fasteners cannot be avoided, supply corrosion-resistant fasteners with heads matching color of metal wall panels by means factory-applied coating.

2.4 SECONDARY METAL FRAMING

A. Miscellaneous Framing Components, General: Cold-formed metallic-coated steel sheet, ASTM A 653/A 653M, G90 (Z180).

1. Hat Channels: 0.053 inch/16 ga. (1.34 mm) minimum.
2. Sill Channels: 0.053 inch/16 ga. (1.34 mm) minimum.

2.5 METAL WALL PANEL FINISHES

A. Exposed Coil-Coated Finish System:

1. Fluoropolymer Three-Coat System: 0.8 mil primer with 0.8 mil 70 percent PVDF fluoropolymer color coat, and a 0.8 mil 70 percent PVDF fluoropolymer clear coat, AAMA 620.
    a. Basis of Design: CENTRIA Duraguard Plus.

B. Color:

1. Exterior Surface: Match Architect's custom color.
2. Interior Surface: Manufacturer's standard primer color.

2.6 EXPOSED FASTENER METAL WALL PANELS

A. Metal Wall Panel Description:
1. Profile: Longitudinal ribs 3/8" deep, spaced 3" on center.
2. Size: 36" cover width, lengths indicated on drawings.
3. Material: Galvanized steel sheet conforming to ASTM A653, G90 coating, 26-gauge sheet thickness.
4. Finish: Siliconized polyester color coat applied to sight-exposed face of sheet after pretreatment and priming in accordance with coating manufacturer's recommendations.
5. Color: Selected from full range of manufacturer's standard colors.
6. Trim: Manufacturer's standard sheet metal matching panel material and finish, break-formed to profiles indicated on drawings.

B. Product/Manufacturer: Equal to McElroy Metals; Mini-Rib wall panels.

C. Location: Backside of parapets walls and elsewhere as indicated on the Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine metal wall panel substrate with Installer present. Inspect for erection tolerances and other conditions that would adversely affect installation of metal wall panels.

B. Wall Substrate: Confirm that wall substrate is within tolerances acceptable to metal wall panel system manufacturer.
1. Maximum substrate and framing deviations from flat plane acceptable:
   a. 1/4-inch in 20 feet vertically or horizontally.
   b. 1/2-inch across building elevation.
   c. 1/8-inch in 5 feet.

C. Framing: Inspect framing that will support metal wall panels to determine if support components are installed as indicated on approved shop drawings. Confirm presence of acceptable framing members at recommended spacing to match installation requirements of metal wall panels.

D. Openings: Verify that window, door, louver and other penetrations match layout on shop drawings.

E. Air/Moisture Barriers: Confirm that work has been completed, inspected, and tested as required.

F. Correct out-of-tolerance work and other deficient conditions prior to proceeding with metal wall panel system installation.

3.2 SECONDARY FRAMING INSTALLATION

A. Secondary Metal Framing: Install secondary metal framing components to tolerance indicated, as shown on approved shop drawings. Install secondary metal framing and the metal panel supports per ASTM C 1007 and metal wall panel manufacturer's recommendations.

3.3 CONCEALED FASTENER METAL WALL PANEL INSTALLATION

A. General: Install metal wall panels in accordance with approved shop drawings and manufacturer's recommendations. Install metal wall panels in orientation, sizes, and locations indicated. Anchor metal wall panels and other components securely in place. Provide for thermal and structural movement

B. Attach panels to metal framing using recommended clips, screws, fasteners, sealants, and adhesives indicated on approved shop drawings.

1. Fasteners for Steel Wall Panels: Stainless-steel for exterior locations and locations exposed to moisture; carbon steel for interior use only.
2. Fasten metal wall panels to supports with fasteners and spacing recommended by manufacturer.
3. Provide weatherproof escutcheons for pipe and conduit penetrating exterior walls.
4. Dissimilar Materials: Where elements of metal wall panel system will come into contact with dissimilar materials, treat faces and edges in contact with dissimilar materials as recommended by manufacturer.

C. Joint Sealers: Install joint sealants where indicated on approved shop drawings.

3.4 ACCESSORY INSTALLATION

A. General: Install metal wall panel accessories with positive anchorage to building and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install related flashings and sheet metal trim per requirements of Division 07 Section "Sheet Metal Flashing and Trim."
2. Install components required for a complete metal wall panel assembly, including trim, copings, corners, lap strips, flashings, sealants, fillers, closure strips, and similar items.
3. Comply with performance requirements and manufacturer's written installation instructions.
4. Provide concealed fasteners except where noted on approved shop drawings.
5. Set units true to line and level as indicated.

3.5 EXPOSED FASTENER WALL PANEL INSTALLATION

A. Install panels on walls in accordance with manufacturer's instructions.

B. Fasten panels to structural supports; aligned, level, and plumb.

C. Locate joints over supports. Lap panel ends minimum 2 inches.

D. Provide expansion joints where indicated.

3.6 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a service representative authorized by metal wall panel manufacturer to inspect completed installation. Submit written report.

B. Correct deficiencies noted in manufacturer's report.

3.7 CLEANING AND PROTECTION

A. Remove temporary protective films. Clean finished surfaces as recommended by metal wall panel manufacturer. Clear weep holes and drainage channels of obstructions, dirt, and sealant. Maintain in a clean condition during construction.

B. Replace damaged panels and accessories that cannot be repaired by finish touch-up or minor repair.

END OF SECTION 07421

SECTION 07460 – ALUMINUM SOFFIT

PART 1 - GENERAL

1.1. RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
1. Aluminum soffit.
2. Aluminum decorative accessories.

B. Related Sections include the following:
1. Division 6 Section "Rough Carpentry" for wood blocking.
2. Division 7 Section "Sheet Metal Flashing and Trim" for flashing, gutters, and other sheet metal work.
3. Division 7 Section "Joint Sealants."

1.3 SUBMITTALS

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

B. Samples for Initial Selection: For soffit and decorative accessories.

C. Samples for Verification: For each type, color, texture, and pattern required.
1. 12-inch- long-by-actual-width Sample of soffit.

D. Product Certificates: For each type of soffit, signed by product manufacturer.

E. Research/Evaluation Reports: For each type of siding required.

1.4 QUALITY ASSURANCE

A. Source Limitations for Soffit: Obtain each type, color, texture, and pattern of soffit, including related accessories, through one source from a single manufacturer.

B. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials in a dry, well-ventilated, weathertight place.

1.6 PROJECT CONDITIONS

A. Weather Limitations: Proceed with siding installation only if substrate is completely dry and if existing and forecasted weather conditions permit siding to be installed according to manufacturer's written instructions.

1.7 SEQUENCING

A. Coordinate installation with flashings and other adjoining construction to ensure proper sequencing.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace siding that does not comply with requirements or that fails within specified warranty period. Failures include, but are not limited to, cracking, deforming, fading, or otherwise deteriorating beyond normal weathering.

1. Fading is defined as loss of color, after cleaning with product recommended by manufacturer, of more than 7 Hunter color-difference units as measured according to ASTM D 2244.
2. Warranty Period: 25 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOFFIT

A. Aluminum Soffit: Formed and coated aluminum soffit complying with AAMA 1402, including Paragraph 3.2.4.2.2, "High Performance Coating."

1. Manufacturers:
   a. Alcoa Building Products, Inc.
   b. Gentek Building Products, Inc.
   c. Kaycan Ltd.
   d. Norandex Inc./Reynolds Distribution Company.
   e. Rollex Corporation.
2. Pattern: 12-inch (305-mm) exposure in V-grooved, double 6-inch (152-mm) board style.
3. Texture: Smooth.
4. Ventilation: Provide perforated soffit, unless otherwise indicated.
5. Minimum Nominal Thickness: 0.019 inch.
6. Finish: Manufacturer's standard primer and baked-on polyester finish.
7. Colors for Aluminum Soffit: As selected by Architect from manufacturer's full range.

2.2 ACCESSORIES

A. Aluminum Accessories: Where aluminum accessories are indicated, provide accessories complying with AAMA 1402, including Paragraph 3.2.4.2.2, "High Performance Coating."

1. Texture: Smooth.
2. Minimum Nominal Thickness: 0.019 inch.
3. Finish: Manufacturer's standard primer and baked-on polyester finish.

B. Decorative Accessories: Provide the following types of decorative accessories as indicated:

1. Moldings and trim.

C. Colors for Decorative Accessories: As selected by Architect from manufacturer's full range.

D. Fasteners:

1. For fastening to metal, use ribbed bugle-head screws of sufficient length to penetrate a minimum of 1/4 inch (6 mm) or 3 screw-threads into substrate.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of siding. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of projections and substances detrimental to application.

3.3 INSTALLATION

A. General: Comply with siding manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply. Center nails in elongated nailing slots without binding siding to allow for thermal movement. Overlap joints to shed water away from direction of prevailing wind.

B. Install aluminum soffit and accessories according to AAMA 1402.

C. Isolate dissimilar metals by separating with rubber gaskets or elastomeric sealant. Use rubber washers where fasteners made from dissimilar metal penetrate siding. Isolate dissimilar metals behind siding by covering with polyethylene film.

3.4 ADJUSTING AND CLEANING

A. Remove damaged, improperly installed, or otherwise defective siding materials and replace with new materials complying with specified requirements.

B. Clean finished surfaces according to siding manufacturer's written instructions and maintain in a clean condition during construction.

END OF SECTION 07460

SECTION 07475 - TERRA COTTA PANEL RAIN SCREEN SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. The work of this section includes, but shall not be limited to, unitized (panelized) terra cotta panel rain screen system, a component of the exterior cladding system, consisting of the following:

1. Aluminum vertical track and clip (secondary support) system.
2. Extruded hollow terra cotta panels.
3. Silicone gaskets and isolators.
4. Anchors, fasteners, flashings, weather seals, cover plates and formed metal trim through and at the perimeter of the terra cotta panel rain screen system and other accessories required for a complete installation.

B. Related work:

1. Division 3, Cast-in-place and precast concrete.
2. Division 4, Unit masonry assemblies.
3. Division 5, Cold-formed metal framing.
4. Division 6, Exterior sheathing, Rough Carpentry.
5. Division 7, Insulation, flashings, firestop systems, air and vapor barriers, and joint sealers.
6. Division 8, Exterior aluminum curtain wall framing, windows, glass, and glazing.

1.2 SYSTEM DESCRIPTION

A. Design Criteria: Terra cotta panel rain screen system to be based on Construction Documents and Specifications, which indicate sizes, profiles, finishes, and dimensional requirements and shall consist of:

1. Hollow terra cotta panels hung on a pre-engineered aluminum track system with aluminum clip supports, gasket and trim.
2. Silicone gaskets inserted into vertical track and silicone isolators wrapped around clips; provide shadow line (standard black) at vertical joint and compression bubbles in every track to maintain panel position across the façade and prevent wind induced rattle.
3. Track to be attached to specified portion of wall assembly structurally sufficient to carry the terra cotta panel rain screen system and associated loads. Standard system weighs approximately 16-17 lbs/sq.ft.

B. System shall be designed as a "rain screen" to allow for the following:

1. Ventilated or Pressure equalization in the air space behind the terra cotta panel.
2. Movements within the structure, as specified in 1.3 Performance Requirements of this Section, and to fit within the space allotted without projections into adjacent finished space.

C. Flatness: System shall be flat with no noticeable warp, buckling, deflections or other surface irregularities within manufacturer's specified tolerances.

1.3 PERFORMANCE REQUIREMENTS

A. General: Design, fabricate and install components so that the completed exterior wall system will withstand live loads, the inward and outward pressures specified, and loads stipulated by the Building Code in effect for this Project.

1. The system shall have a design load of positive and negative pressures up to 45 psf when

tested in accordance with ASTM E 330.

2. Deflections within the system are to be limited to L/360 of their clear span or 5/8", whichever is less when tested in accordance with ASTM E 330.

3. The system shall be attached to a wall whose deflections are limited to L/360 or 5/8", whichever is less.

B. Movement: Design, fabricate and install system to withstand building seismic and thermal movements including deflections, temperature change without buckling, distortion, joint failure, panel fallout or breakage or undue stress on system components, anchors or permanent deformation of any kind in accordance with:

1. AAMA 501.4 for Static Seismic and Wind Induced Interstory Drifts
2. AAMA 501.6 for Dynamic Seismic Drift.

C. Infiltration/Penetration: The work of this Section shall be constructed to prevent air and water infiltration as outlined below:

1. ASTM E 283 - Air Infiltration: Allowable air infiltration will be 0.06 cfm or less per square foot when tested under a constant pressure of 6.24 psf.
2. ASTM E 331 - Water Penetration: No uncontrolled water penetration shall occur when tested in static and dynamic modes, under a constant pressure of 15 psf with 5 gallons of water per hour applied per square foot for a period of 15 minutes.
3. AAMA 501.1 - Standard Test Method for Exterior Windows, Curtain Wall and Doors for Water Penetration Using Dynamic Pressure.
4. The complete system is to be designed to evacuate any moisture which penetrates beyond the outside surface materials and to weather proof with membrane flashing around all perimeters and openings through the system.

D. High Velocity Hurricane Zone - System to be able to withstand the following tests associated with HVHZ and Miami-Dade NOA

1. TAS 201-94 - Impact Test Procedures - Large Missile Impact
2. TAS 202-94 - Criteria for Testing Products Subject to Cyclic Wind Pressure Loading.
3. TAS 203-94 - Criteria for Testing Impact & Non Impact Resistant Building Envelope Components Using Uniform Static Air Pressure.
4. ASTM E 1886 - Standard Test Method for Performance of Exterior
5. Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials
6. ASTM E 1996-06 - Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors and Impact Protective Systems by Windborne Debris in Hurricanes.

E. Color/Finish: Terra Cotta Panels shall be fired clay materials that achieve their final through-body or glaze color and texture through a kiln firing process forming permanent bonds.

F. Testing:

1. Absorption (ASTM C67): 4.0% to 7.0%. Sec 2507 4
2. Modulus of Rupture (ASTM C99): 2,231 to 3,717 psi.
3. Flexural Strength (ASTM C880): 2,280 to 3,457 psi.
4. Weight (ASTM C67): 130 to 135 lbs/cu.ft.
5. Weight per Unit Area (standard panel): 13 to 16 lbs/sq.ft.
6. Linear Coefficient of Thermal Expansion: 3.5 x 10-4 %.
7. Freeze and Thaw (ASTM C67): 300 cycles.
8. Hardness (Various Standard Colors): 7 to 9 Mohs scale.

9. Efflorescence (ASTM C67): Not effloresced.
10. Chemical Resistance (ASTM C126): No change in color or texture.

G. Fabrication tolerances:
1. Dimensional Tolerance: 0.039 inch for any cut length up to 60 inches.
2. Height: Plus or minus 1/16 inch up to 10 inches; plus or minus 3/32 inch up to 15 inches; plus or minus 1/8 inch up to 20 inches, plus or minus 5/32 inch up to 24 inch.
3. Thickness, Cross Section of Panel: Plus or minus 1/16 inch.
4. Straightness ("sweep"): Plus or minus 0.25 % of length.
5. Diagonal Flatness: Plus or minus 0.25 % of diagonal.
6. Vertical Flatness: Plus or minus 1.0 % of height.
7. Torsion: Plus or minus 0.25 % of diagonal.

1.4 SUBMITTALS

A. Shop Drawings: Complete shop drawings shall be submitted for approval prior to fabrication including:
1. Elevations for each condition indicating terra cotta panel type and location.
2. Section details, to convey proper fabrication/installation for terra cotta panel types.
3. Shop drawings for wall assembly to receive terra cotta panel rain screen system to be coordinated with terra cotta panel rain screen system shop drawings.

B. Samples: 3 sets of the following samples in the selected finish and color.
1. Initial color, if custom, will be submitted on a 6”h x 6”w tile. Standard colors may be selected from manufacturer's color box.
2. Two 12-inch long by full size profile of each type of panel. Samples shall represent the full range of color and texture proposed for the Work.
3. One12-inch long by full profile sample of each type sheet metal trim and closure piece.

C. Product Data: Manufacturer's latest published literature describing each product selection.

D. LEED Information:
1. Manufacturer shall supply a document on company letterhead stating:
a. Material & Resources requirement 1
b. Material & Resources requirement 2.

E. Project Specific Tests: If Project Specific Test are required:
1. Manufacturer and fabricator to certify that performance tests specified have been performed and that products or systems, including finishes, comply with specified requirements.
2. Submit 2 copies of test reports, prepared by the testing agency, for each specified test showing required performance criteria and test results.
3. Include reports of failures and remedial actions taken in test reports Arrange with the testing agency to prepare test reports in accordance with reporting procedures described in the Project Specified Test Standards.

1.5 QUALITY ASSURANCE

A. Installer/Fabricator Qualifications: Engage an experienced Installer/Fabricator, who has specialized in the erection and installation of types of systems similar to that required for this Project, to erect the terra cotta panel rain screen system.

1. Installer/Fabricator shall be trained by the manufacturer and has engaged in similar work for a period of no less than 5 years.

B. Manufacturer's qualifications: Engage a Manufacturer experienced in the manufacture of terra cotta panel rain screen system similar to those indicated for the Project, and with a record of successful in-service performance.

C. Single responsibility:

1. The terra cotta panel rain screen system, including panels, vertical track, clips and gaskets/isolators, shall be provided by the same firm unless otherwise noted.
2. The terra cotta panel rain screen system shall have been in use for at least 5 years.

D. Mockup: Provide one completely assembled wall area, as shown in the Construction Documents, installed with all related accessories, in composite configurations and representative of the design as shown on the Drawings.

1. Product used to assemble the mockup shall be the same as that to be installed onto the building.
2. Extent of mockup shall be the same as that which will be provided in the final work.
3. Mockup shall be installed simulating actual construction conditions, including actual structural supports and connections. Use means, methods and techniques proposed for final installation.
4. Locate mockup in location as directed by the Architect.
5. Personnel assembling mockup shall be the same personnel that will perform the actual work at the project site.

E. Pre-Construction Compatibility and Adhesion Testing: Submit to joint sealant manufacturer samples of material that will contact or affect joint sealants for compatibility and adhesion testing as indicated below:

1. Use test methods standard with manufacturer to determine if priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
    a. Perform tests under normal environmental conditions that will exist during actual installation.

F. Pre-Installation Inspection: Installer to contact manufacturer of the terra cotta panel rain screen system Owner and Architect, prior to installation of terra cotta panel rain screen system if site conditions adverse to proper installation of the system exist.

1.6 HANDLING

A. Protect components from adverse job conditions prior to installation.

B. Protect components from other trades after installation.

C. Storage:
1. Store components on platforms or pallets, covered with tarpaulins or other suitable weather-tight ventilated covering. Store components so that water accumulations will drain freely.
2. Do not store terra cotta panels in contact with other materials that might cause staining, surface damage, or other deleterious effect.
3. Do not stack platforms or pallets one on top of another.

1.7 SPECIAL WARRANTY

A. Manufacturer shall warrant the material of this Section for a period of 5 years from date of Substantial Completion against possible material defects.

B. Installer shall warrant the workmanship of this Section for a period of 2 years from date of Substantial Completion against defects in Workmanship.

C. The installation warranty shall provide that the exterior wall system will remain weather tight during the warranty period and that if any leaks occur due to faulty installation practices, components of the system will be repaired or replaced as required to render the system weather-tight, at no cost to the Owner.

D. The warranty shall cover labor and materials.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURER

A. Subject to compliance with requirements, manufacturer offering terra cotta panel rain screen system that may be incorporated in the work include the following:
1. Equal to TerraClad™ by Boston Valley Terra Cotta USA, toll free 888.214.3655, tel. 716.649.7490 - www.bostonvalley.com.

2.2 MATERIALS
B. Hollow terra cotta panels complying with the following:
1. Finish: Standard.
2. Size: As indicated on the Drawings.
3. Color: To be selected from manufacturer's standard colors.

C. Fasteners, clips, and vertical track: In accordance with manufacturer's recommendations to meet performance criteria specified.

D. Vertical track:
1. Aluminum alloy 6105 T5, mill finished.

E. Flashing, Trim and other Accessories: Shop-fabricated, corrosion-resistant type capable of complying with the performance criteria specified and designed to allow adjustments of system prior to being permanently fastened.

F. Supporting system fastening method: Pre-engineered aluminum track, and clip, complying with the following.

1. Panels fastened at head grooves and base channels using aluminum clips inserted into vertical track.
2. The aluminum vertical track is fastened to the building wall system as shown on the Construction Documents or Installation Contractor's Shop Drawings.
3. The replacement of damaged panels, particularly in the field, must be possible using simple methods and shall not require special tools nor damage the surrounding panels.
4. Silicone gaskets shall be colored black, unless specified by the Architect to match the panel color.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Terra cotta panel rain screen system installer to examine conditions affecting the work of this Section at site. If any conditions exist that would be detrimental to proper installation of terra cotta panel rain screen system, installer is to notify Architect and General Contractor / Construction Manager in writing.

B. Correct conditions detrimental to the proper and timely completion of this work before proceeding with installation.

3.2 INSTALLATION

A. Do not install broken, chipped or cracked panels.

B. Apply coat of bituminous paint on concealed aluminum surfaces to be in contact with steel, cementitious, and dissimilar materials.

C. Install terra cotta panel rain screen system to wall assembly specified in accordance with the approved shop drawings and their manufacturer's instructions.

D. Conceal fasteners.

E. Place terra cotta panels in to lines and levels, plumb, with uniform, parallel joints, in accordance with their manufacturer's instructions.

1. Use caution to prevent damage to terra cotta panels.
2. When field-cutting, use caution to ensure that cuttings do not remain on exposed surfaces. Cut edges shall be sharp, without spalling.
3. Cutting shall be performed with a diamond tipped wet saw.

F. Ensure that assembly is plumb, level and free of warp or twist; maintain dimensional tolerances and alignment with adjacent work.

G. Built-in work:

1. As work progresses, build in flashing and other items.
2. Where applicable, remove protective film from finished aluminum surfaces.

H. Tolerances: Accurately align and locate components to column lines and floor levels; adjust work to conform to the following tolerances.

1. Plumb: 1/8-inch in 10 feet; 1/4-inch in 40 feet; non-cumulative.
2. Level: 1/8-inch in 20 feet; 1/4-inch in 40 feet; non-cumulative.
3. Alignment: Limit offset to 1/16-inch where surfaces are flush or less than 1/2-inch out of flush, and separated by less than 2 inches (by reveal or protruding work); otherwise limit offsets to 1/8 inch.
4. Location: 3/8-inch maximum deviation from measured theoretical location any member, and location.
5. Lipping between units: 1/16 inch maximum.
6. Finished work shall be viewed from a distance of 15 feet per ASTM C216-07a.

3.3 CLEANING

A. Clean soiled surfaces using materials which will not harm terra cotta panels or adjacent materials, as recommended by the terra cotta panel manufacturer (clean with mild detergent using a natural bristle brush, starting from top of building to the bottom). Use non-metallic tools in cleaning operations. Pressure washer not to exceed 1200 psi.

B. Upon completion of installation, remove protective coatings or coverings and clean aluminum surfaces, exercising care to avoid damage of finish.

C. Remove excess sealant compounds, dirt or other foreign substances.

D. Remove and replace terra cotta panels that are broken, chipped, cracked, abraded or damaged during construction period. Reinstall in accordance with their manufacturer's instructions.

END OF SECTION 07475

SECTION 07550 - MODIFIED BITUMINOUS MEMBRANE ROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
1. Modified bituminous membrane roofing system with mineral granule surface.
2. Roofing insulation.

B. Related Sections include the following:
1. Division 6 Section "Rough Carpentry" for wood blocking, curbs, cants, and nailers.
2. Division 7 Section "Sheet Metal Flashing and Trim" for metal roof penetration flashings, flashings, and counterflashings.
3. Division 7 Section "Joint Sealants."
4. Division 15 Section "Plumbing Specialties" for roof drains.

1.3 DEFINITIONS

A. Roofing Terminology: Refer to ASTM D 1079 for definitions of terms related to roofing work not otherwise defined in this Section.

B. Hot Roofing Asphalt: Roofing asphalt heated to its equiviscous temperature, the temperature at which its viscosity is 125 centipoise for mop-applied roofing asphalt and 75 centipoise for mechanical spreader-applied roofing asphalt within a range of plus or minus 25 deg F measured at the mop cart or mechanical spreader immediately before application.

1.4 PERFORMANCE REQUIREMENTS

A. General: Install a watertight, modified bituminous membrane roofing and base flashing system with compatible components that will not permit the passage of liquid water and will withstand wind loads, thermally induced movement, and exposure to weather without failure.

B. FM Listing: Provide modified bituminous membrane, base flashings, and component materials that meet requirements of FM 4450 and FM 4470 as part of a roofing system and that are listed in FM's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FM markings.
1. Roofing system shall comply with the following:
a. Fire/Windstorm Classification: Class 1A-90.

1.5 SUBMITTALS

A. Product Data: For each type of roofing product specified. Include data substantiating that materials comply with requirements.

B. Samples for Verification: Of the following products:

C. Installer Certificates: Signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install specified roofing system and is eligible to receive the standard roofing manufacturer's warranty.

D. Manufacturer Certificates: Signed by roofing system manufacturer certifying that the roofing system complies with requirements specified in the "Performance Requirements" Article. Upon request, submit evidence of complying with requirements.

E. Maintenance Data: For roofing system to include in the maintenance manuals specified in Division 1.

F. Warranty: Sample copy of standard roofing manufacturer's warranty stating obligations, remedies, limitations, and exclusions of warranty.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer to perform Work of this Section who has specialized in installing roofing similar to that required for this Project; who is approved, authorized, or licensed by the roofing system manufacturer to install manufacturer's product; and who is eligible to receive the standard roofing manufacturer's warranty.

B. Fire-Test-Response Characteristics: Provide roofing materials with the fire-test-response characteristics indicated as determined by testing identical products per test method indicated below by UL, FM, or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

C. Preliminary roofing conference below is suggested for large or complicated installations. Revise timing during construction to suit Project. Delete if unnecessary.

D. Preinstallation conference below is recommended with or without preliminary roofing conference above. Coordinate with Division 1 Section "Project Meetings."

E. Pre-Roofing Conference:

1. A pre-roofing conference is required before any roofing materials are installed. This conference shall be conducted by a representative of the Architect and attended by representatives of the Owner, Building Commission Inspector, General Contractor, Roofing Contractor, Owner Waterproofing Consultant, Sheet Metal Contractor, Roof Deck Manufacturer (if applicable), and the Roofing Materials Manufacturer (if warranty is required of this manufacturer). If equipment of substantial size is to be placed on the roof, the Mechanical Contractor must also attend this meeting.

2. The pre-roofing conference is intended to clarify application requirements for work to be completed before roofing operations can begin. This would include a detailed review of the specifications, roof plans, roof deck information, flashing details, and approved shop drawings, submittal data, and samples. If conflict exists between the specifications and the Manufacturer's requirements, this shall be resolved. If this pre- roofing conference cannot be satisfactorily concluded without further inspection and investigation by any of the parties present, it shall be reconvened at the earliest possible time to avoid delay of the work. In no case should the work proceed without inspection of all roof deck areas and substantial agreement on all points.

a. The following are to be accomplished during the conference:

1) Review all Factory Mutual and Underwriters Laboratories requirements listed in the specifications and resolve any questions or conflicts that may arise.

2) Establish trade-related job schedules, including the installation of roof-mounted mechanical equipment.

3) Establish roofing schedule and work methods that will prevent roof damage.

4) Require that all roof penetrations and walls be in place prior to installing the roof.

5) Establish those areas on the job site that will be designated as work and storage areas for roofing operations.

6) Establish weather and working temperature conditions to which all parties must agree.

7) Establish acceptable methods of protecting the finished roof if any trades must travel across or work on or above any areas of the finished roof.

F. The Architect shall prepare a written report indicating actions taken and decisions made at this pre-roofing conference. This report shall be made a part of the project record and copies furnished the General Contractor, the Owner, the Building Commission, and the Building Commission Inspector."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store roofing materials in a dry, well-ventilated, weathertight location to ensure no significant moisture pickup and maintain at a temperature exceeding roofing system manufacturer's written instructions. Store rolls of felt and other sheet materials on end on pallets or other raised surfaces. Do not double-stack rolls.

1. Handle and store roofing materials and place equipment in a manner to avoid significant or permanent damage to deck or structural supporting members.

B. Do not leave unused felts and other sheet materials on the roof overnight or when roofing work is not in progress unless protected from weather and moisture and unless maintained at a temperature exceeding 50 deg F.

C. Deliver and store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer.

D. Protect roofing insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

1.8 PROJECT CONDITIONS

A. Weather Limitations: Proceed with roofing work only when existing and forecasted weather conditions permit roofing to be installed according to manufacturers' written instructions and warranty requirements.

1.9 WARRANTY

A. General Warranty: The warranties specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Standard Roofing Manufacturer's Warranty: Submit an executed copy of roofing manufacturer's standard Limited Service Warranty agreement including flashing endorsement, without monetary limitation, signed by an authorized representative of modified bitumen sheet roofing system manufacturer, on form published with product literature, for the following warranty period:

1. Warranty Period: 20 years.

C. Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering Work of this Section, including membrane roofing, base flashing, roofing insulation, and fasteners for the following warranty period:

1. Warranty Period: 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SBS-MODIFIED BITUMINOUS SHEET

A. Insulated-Deck, Modified Bitumen Membrane/Fully Adhered (IMBF):

B. Contractor's Options: Contractor shall have the option of providing any one of the following three Tamko Asphalt Products, Inc. roofing systems:

1. 108 AWAPLAN Premium.
2. 109 AWAPLAN Premium.

C. Equivalent Systems: Subject to compliance with the requirements, and approval by the Architect, equivalent 20-year guarantee-able systems by any of the following manufacturers are acceptable:

1. GAF Materials Corp.
2. Manville Sales Corp.

2.2 AUXILIARY MEMBRANE MATERIALS

A. General: Furnish auxiliary materials recommended by roofing system manufacturer for intended use and compatible with SBS-modified bituminous roofing.

1. Furnish liquid-type auxiliary materials that meet VOC limits of authorities having jurisdiction.

B. Asphalt Primer: ASTM D 41.

C. Roofing Asphalt: ASTM D 312, Type III or Type IV, as recommended by modified bituminous membrane manufacturer.

1. Label each container or provide certification with each load of bulk asphalt identifying type of roofing asphalt and indicating softening point, minimum flash point, equiviscous temperature, and finished blowing temperature.

D. Cold-Applied Adhesive: Roofing system manufacturer's standard asphalt-based, 1- or 2- part, asbestos-free, cold-applied adhesive specially formulated for compatibility and use with modified

bituminous membrane roofing and flashings.

E. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions of FM 4470; designed for fastening base sheets, base-ply felts, and base flashings and for backnailing modified bituminous membrane to substrate; tested by manufacturer for required pullout strength; and acceptable to roofing system manufacturer.

F. Metal Flashing Sheet: Metal flashing sheet is specified in Division 7 Section "Sheet Metal Flashing and Trim."

G. Wood Nailer Strips: Furnish wood nailer strips complying with requirements of Division 6 Section "Rough Carpentry."

H. Cants: Provide treated wood cants of materials specified in Division 6 Section "Rough Carpentry."

I. Miscellaneous Accessories: Provide miscellaneous accessories recommended by roofing system manufacturer for intended use.

2.3 INSULATION MATERIALS

A. General: Provide preformed, roofing insulation boards that comply with requirements, selected from manufacturer's standard sizes and of thicknesses indicated.

1. Provide preformed, tapered insulation boards where indicated. Fabricate with the following taper:
   a. As indicated on Drawings.
2. Provide tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

B. Composite Polyisocyanurate Board Insulation: ASTM C 1289, faced with insulation board on one major surface, as indicated below by type, and felt or glass-fiber mat facer on the other.

1. Available Manufacturers:
   a. Apache Products Company.
   b. Atlas Roofing Corporation.
   c. Celotex Corporation.
   d. Firestone Building Products Company.
   e. GAF Materials Corporation.
   f. Honeywell Commercial Roofing Systems.
   g. Hunter Panels, LLC.
   h. Johns Manville International, Inc.
   i. Koppers Industries.
   j. RMAX.
2. Type III (perlite-insulation-board facer), 3/4 inch thick.

2.4 INSULATION ACCESSORIES

A. General: Furnish roofing insulation accessories recommended by insulation manufacturer for intended use and compatible with sheet roofing material.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions under which roofing will be applied, with Installer present, for compliance with requirements.

B. Verify that roof openings and penetrations are in place and set and braced and that roof drains are properly clamped into position.

C. Wood blocking, curbs, and nailers are required at edges of roof penetrations and terminations. Wood nailers are not required on lightweight insulating concrete decks or on nailable decks not covered with roofing insulation.

D. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at roof penetrations and terminations and match the thicknesses of insulation required.

E. Verify that flatness and fastening of metal roof decks comply with installation tolerances.

F. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrate of dust, debris, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install modified bituminous membrane roofing system according to roofing system manufacturer's written instructions and applicable recommendations of NRCA/ARMA's "Quality Control Recommendations for Polymer Modified Bitumen Roofing."

B. Shingling Plies: Install modified bituminous membrane roofing system with ply sheets shingled uniformly to achieve required number of membrane plies throughout. Shingle in direction to shed water.

C. Cant strips may be mechanically fastened or set in hot asphalt depending on substrate and roofing system manufacturers' written instructions.

D. Cant Strips: Install and secure preformed 45-degree cant strips at junctures of modified bituminous membrane roofing system with vertical surfaces or angle changes greater than 45 degrees.

E. Cooperate with inspecting and testing agencies engaged or required to perform services for installing modified bituminous membrane roofing system.

F. Coordinate installing roofing system components so insulation and roofing plies are not exposed to precipitation or left exposed at the end of the workday or when rain is forecast.

1. Provide cutoffs at end of each day's work to cover exposed ply sheets and insulation with a course of coated felt with joints and edges sealed.
2. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system.
3. Remove and discard temporary seals before beginning work on adjoining roofing.

G. Asphalt Heating: Heat roofing asphalt and apply within plus or minus 25 deg F of equiviscous temperature, unless otherwise required by roofing system manufacturer. Do not raise roofing asphalt temperature above the equiviscous temperature range more than one hour before time of application. Do not exceed roofing asphalt manufacturer's recommended temperature limits during roofing asphalt heating. Do not heat roofing asphalt within 25 deg F of flash point. Discard roofing asphalt maintained at a temperature exceeding 500 deg F for more than 4 hours. Keep kettle lid closed, unless adding roofing asphalt.

1. Substrate-Joint Penetrations: Prevent roofing asphalt from penetrating substrate joints, entering building, or damaging roofing system components or adjacent building construction. If mopping is applied directly to substrate, tape substrate joints.

3.4 INSULATION INSTALLATION

A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with roofing system manufacturer's written instructions for installing roofing insulation on the indicated substrate and as required to achieve FM Windstorm Resistance Classification.

C. Install tapered insulation under area of roofing to conform to slopes indicated and to Shop Drawings.

D. Install one or more layers of insulation under area of roofing to achieve required thickness, unless otherwise required by roofing system manufacturer. Where overall insulation thickness is 2 inches or greater, install required thickness in 2 or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches in each direction.

E. Trim surface of insulation where necessary at roof drains so completed surface is flush with ring of drain.

F. Install insulation with long joints of insulation in continuous straight lines with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch with insulation.

1. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.

G. Mechanically Fastened and Adhered Insulation: Install each layer of insulation and secure first layer of insulation to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.

1. Fasten first layer of insulation according to requirements in FMG's "Approval Guide" for specified Windstorm Resistance Classification.
2. Select one of two subparagraphs below.
3. Install subsequent layers of insulation in a cold fluid-applied adhesive.

3.5 ROOF MEMBRANE INSTALLATION

A. General: Install modified bituminous membrane over area to receive roofing, according to manufacturer's written instructions. Extend modified bituminous membrane over and terminate beyond cants at counterflashing.

1. Unroll sheet and allow it to relax for the minimum time period required by manufacturer.

B. Laps: Accurately align sheets, without stretching, and maintain uniform side and end laps. Stagger end laps. Completely bond and seal laps, leaving no voids.

1. Repair tears and voids in laps and lapped seams not completely sealed.

C. Install modified bituminous membranes with side laps shingled with slope of roof deck where possible.

3.6 FLASHING AND STRIPPING INSTALLATION

A. Install modified bituminous membrane base flashing over cant strips and other sloping and vertical surfaces, at roof edges, and at penetrations through roof, and secure to substrates according to roofing system manufacturer's written instructions and as follows:

B. Smooth surfaces of masonry and concrete walls and parapets usually require priming before applying hot asphalt or cold adhesive.

1. Prime substrates with asphalt primer if required by roofing system manufacturer.
2. Base Flashing Application: Adhere modified bituminous membrane base flashing to substrate in a uniform mopping of Type III hot roofing asphalt, applied to substrate and back of base flashing at rate required by roofing system manufacturer.
3. Extend flashing a minimum of 6-inches onto modified bitumen sheet roofing. Base flashing shall be applied after mineral surfaced cap sheet.

C. Extend base flashing up the wall a minimum of 8 inches above roof membrane.

D. Mechanically fasten top of modified bituminous membrane base flashing securely at terminations and perimeter of roofing.

E. Install modified bituminous stripping where metal flanges and edgings are set on membrane roofing, according to roofing system manufacturer's written instructions.

F. Roof Drains: Set 30-by-30-inch metal flashing in bed of asphalt roofing cement on completed modified bituminous membrane roofing. Cover metal flashing with modified bituminous stripping extending a minimum of 4 inches beyond edge of metal flashing onto field of roof membrane. Clamp roof membrane, metal flashing, and stripping into roof-drain clamping ring.

3.7 PROTECTING AND CLEANING

A. Protect modified bituminous membrane roofing from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove modified bituminous roofing that does not comply with requirements, repair substrates, reinstall roofing, and repair base flashings to a condition free of damage and deterioration at the time of Substantial Completion and according to warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 07550

SECTION 07620 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Fabricated sheet metal items, including flashings, counterflashings, gutters, downspouts, exposed trim, rakes, and fasciae,, and other items indicated in Schedule.

B. Reglets and accessories.

C. Precast concrete splash pads.

1.2 RELATED REQUIREMENTS

A. Section 04810 - Unit Masonry Assemblies: Through-wall flashings in masonry.

B. Section 06100 - Rough Carpentry: Wood nailers.

C. Section 07311 - Asphalt Shingles: Flashings associated with shingle roofing.

D. Section 07411 - Preformed Metal Roofing: Roofing system.

E. Section 07900 - Joint Sealers.

1.3 REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; American Architectural Manufacturers Association; 1998.

B. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels; 2002.

C. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels; 2005.

D. ASTM B 209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2007.

E. ASTM B 209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric]; 2007.

F. ASTM B 749 - Standard Specification for Lead and Lead Alloy Strip, Sheet, and Plate Products; 2003 (Reapproved 2009).

G. ASTM D 4586 - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007.

H. SMACNA (ASMM) - Architectural Sheet Metal Manual; Sheet Metal and Air Conditioning Contractors' National Association; 2003.

1.4 SUBMITTALS

A. See Section 01300 - 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, 12 x 12 inch in size illustrating material of typical standing seam.

D. Samples: Submit two samples 4 x 4 inch in size illustrating metal finish color.

1.5 QUALITY ASSURANCE

A. Perform work in accordance with SMACNA Architectural Sheet Metal Manual requirements and standard details, except as otherwise indicated.

B. Fabricator and Installer Qualifications: Company specializing in sheet metal work with three years of documented experience.

1.6 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

2.1 SHEET MATERIALS

A. Pre-Finished Aluminum: ASTM B 209 (ASTM B 209M); 0.032 inch thick unless noted otherwise below; plain finish shop pre-coated with fluoropolymercoating.

1. Modified Silicone Polyester Coating: Pigmented Organic Coating System, AAMA 2603; baked enamel finish system.
   a. Location: At non-exposed to view sheet metal.
   b. Color: As selected by Architect from manufacturer's standard colors.
2. Fluoropolymer Coating: High Performance Organic Finish, AAMA 2604; multiple coat, thermally cured fluoropolymer finish system.
   a. Location: At all exposed to view sheet metal.
3. Color: As selected by Architect from manufacturer's custom colors to match adjacent metal roofing or other exterior color(s).

B. Lead: ASTM B 749, 2.5 lb/sq ft thick.

2.2 CONCEALED THROUGH-WALL SHEET METAL FLASHING

A. See Section 04810 - Unit Masonry Assemblies.

2.3 ACCESSORIES

A. Fasteners: Same metal as sheet metal flashing or other noncorrosive metal as recommended by sheet metal manufacturer. Match finish of exposed heads with material being fastened.

B. Elastomeric Sealant: Generic type recommended by sheet metal manufacturer and fabricator of components being sealed and complying with requirements for joint sealants as specified in Division 7 Section "Joint Sealants."

C. Epoxy Seam sealant: 2-part, non-corrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior and interior non-moving joints, including rivited joints.

D. Barrier Membrane: Provide minimum 15 lb/square membrane of type compatible with roofing material for separation of aluminum flashing from pressure treated wood and cementitious components.

E. Adhesives: Type recommended by flashing sheet metal manufacturer for waterproof and weather-resistant seaming and adhesive application of flashing sheet metal.

F. Metal Accessories: Provide sheet metal clips, straps, anchoring devices, and similar accessory units as required for installation of Work, matching or compatible with material being installed; noncorrosive; size and thickness required for performance.

G. Primer: Zinc chromate type.

H. Protective Backing Paint: Zinc molybdate alkyd.

I. Plastic Cement: ASTM D 4586, Type I.

2.4 FABRICATION

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

B. Form pieces in longest possible lengths.

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

D. Sheet Metal Fabrication Standard: Fabricate sheet metal flashing and trim to comply with recommendations of SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of the item indicated.

E. Comply with details shown to fabricate sheet metal flashing and trim that fit substrates and result in waterproof and weather-resistant performance once installed. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

F. Form exposed sheet metal Work that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems.

G. Seams: Fabricate nonmoving seams in sheet metal with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.

H. Expansion Provisions: Space movement joints at maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions in Work cannot be used or would not be sufficiently weatherproof and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

I. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.

J. Separate metal from noncompatible metal or corrosive substrates by applying barrier membrane to concealed surfaces at locations as recommended by flashing and roofing manufacturer's.

K. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of sheet metal exposed to public view.

L. Fabricate cleats and attachment devices from same material as sheet metal component being anchored or from compatible, noncorrosive metal recommended by sheet metal manufacturer.

M. Size: As recommended by SMACNA manual or sheet metal manufacturer for application but never less than thickness of metal being secured.

N. Fabricate corners from one piece with minimum 18 inch long legs; seam for rigidity, seal with sealant.

O. Fabricate vertical faces with bottom edge formed outward 1/4 inch (6 mm) and hemmed to form drip.

P. Fabricate flashings to allow toe to extend 2 inches over roofing gravel. Return and brake edges.

2.5 GUTTER AND DOWNSPOUT FABRICATION

A. General: Fabricate sheet metal items in thickness or weight needed to comply with performance requirements but not less than that listed below for each application and metal.

B. Gutters: SMACNA Architectural Sheet Metal Manual, Rectangular profile.

C. Downspouts: Rectangular profile.

D. Gutters and Downspouts: Size for rainfall intensity determined by a storm occurrence of 1 in 5 years in accordance with SMACNA Architectural Sheet Metal Manual.

E. Wall Flashing: Fabricate from the following material:
1. Aluminum: 0.032 inch thick.

F. Counterflashing: Fabricate from the following material:
1. Aluminum: 0.032 inch thick.

G. Gutters, Downspouts, Leaderheads, Fascia and Miscellaneous Trim Items: Fabricate from the following material:
1. Aluminum: 0.040 inch thick.

H. Roof-Penetration Flashing: Fabricate from the following material:
1. Deck-Mate as made by Portals Plus, Inc., (630) 766-5240.
2. Roof-Drain Flashing: Fabricate from the following material:
3. Lead: 4.0 lb/sq. ft., hard tempered.

I. Splash Pads: Precast concrete type, of size and profiles indicated; minimum 3000 psi at 28 days, with minimum 5 percent air entrainment.

J. Downspout Boots: Refer to Section 05500 - Miscellaneous Metal Fabrications.

K. Seal metal joints.

2.6 ALUMINUM FINISHES

A. General: Comply with Aluminum Association's (AA) "Designation System for Aluminum Finishes" for finish designations and application recommendations.

B. High-Performance Organic Coating Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturer's instructions.
1. Fluoropolymer 2-Coat Coating System: Manufacturer's standard 2-coat, thermocured system composed of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 605.2.
a. Color and Gloss: As selected by Architect from manufacturer's full range of choices for color and gloss.
b. Shop Finish for Concealed or Semi-Concealed Surfaces of Rain-Drainage Units: Provide manufacturer's standard baked on, white acrylic shop finish on concealed or semi-concealed sheet metal rain drainage units; 1.0 mil dry film thickness minimum.

PART 3 - EXECUTION

3.1 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.

3.2 PREPARATION

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

B. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil.

3.3 INSTALLATION

A. General: Unless otherwise indicated, install sheet metal flashing and trim to comply with performance requirements, manufacturer's installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Anchor units of Work securely in place by methods indicated, providing for thermal expansion of metal units; conceal fasteners where possible, and set units true to line and level as indicated. Install Work with laps, joints, and seams that will be permanently watertight and weatherproof.

B. Install exposed sheet metal Work that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

C. Expansion Provisions: Provide for thermal expansion of exposed sheet metal Work. Space movement joints at maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions in Work cannot be used or would not be sufficiently weatherproof and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

D. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate elastomeric sealant to comply with SMACNA standards. Fill joint with sealant and form metal to completely conceal sealant.

1. Use joint adhesive for nonmoving joints.

E. Seams: Fabricate nonmoving seams in sheet metal with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for added strength.

F. Separations: Separate metal from noncompatible metal or corrosive substrates by installing barrier membrane on concealed surfaces, at locations of contact as recommended by flashing and roofing manufacturer's.

G. Counterflashings: Coordinate installation of counterflashings with installation of assemblies to be protected by counterflashing. Install counterflashings in reglets or receivers. Secure in a waterproof manner by means of snap-in installation and sealant, lead wedges and sealant, interlocking folded seam, or blind rivets and sealant. Lap counterflashing joints a minimum of 2 inches and bed with sealant.

H. Roof-Drainage System: Install drainage items fabricated from sheet metal, with straps, adhesives, and anchors recommended by SMACNA's Manual or the item manufacturer, to drain roof in the most efficient manner. Coordinate roof-drain flashing installation with roof- drainage system installation. Coordinate flashing and sheet metal items for steep-sloped roofs with roofing installation.

I. Equipment Support Flashing: Coordinate equipment support flashing installation with roofing and equipment installation.

J. Roof-Penetration Flashing: Coordinate roof-penetration flashing installation with roofing and installation of items penetrating roof. Install flashing as recommended by manufacturer.

K. Secure flashings in place using concealed fasteners. Use exposed fasteners only where permitted.

L. Apply plastic cement compound between metal flashings and felt flashings.

M. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.

N. Secure gutters and downspouts in place using concealed fasteners.

O. Slope gutters 1/4 inch per foot minimum.

P. Connect downspouts to downspout boots. Grout connection watertight.

Q. Set splash pads under downspouts.

END OF SECTION 07620

SECTION 07720 - ROOF ACCESSORIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Roof hatches.

1.2 RELATED REQUIREMENTS

A. Section 05310 - Steel Deck.

B. Section 07311 - Asphalt Shingles.

C. Section 07411 - Preformed Metal Roof Panels

D. Section 07620 - Sheet Metal Flashing and Trim: Roof accessory items fabricated from sheet metal.

1.3 REFERENCE STANDARDS

A. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2009a.

B. ASTM A 792/A 792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process; 2009a.

C. FM P7825 - Approval Guide; Factory Mutual Research Corporation; current edition.

D. UL (BMD) - Building Materials Directory; current edition.

1.4 SUBMITTALS

A. See Section 01300 - 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.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store products under cover and elevated above grade.

PART 2 - PRODUCTS

2.1 ROOF HATCHES

A. Manufacturers - Roof Hatches:
1. Acudor Products Inc: www.acudor.com.
2. Bilco Co.: www.bilco.com
3. Dur-Red Products: www.dur-red.com.
4. Milcor by Commercial Products Group of Hart & Cooley, Inc: www.milcorinc.com.
5. Substitutions: See Section 01600 - Product Requirements.

B. Roof Hatches: 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. For Ladder Access: Single leaf; 36 by 36 inches.

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 thick.
2. Finish: Factory prime paint.
3. Insulation: 1 inch rigid glass fiber, located on outside face of curb.

D. Metal Covers: Flush, insulated, hollow metal construction.
1. Capable of supporting 40 psf live load.
2. Material: Galvanized steel; outer cover 14 gage, 0.0747 inch thick, liner 22 gage, 0.03 inch thick.
3. Finish: Factory prime paint.
4. Insulation: 1 inch 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 load.
2. Hinges: Heavy duty pintle 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

3.1 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.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

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

3.4 CLEANING

A. Clean installed work to like-new condition.

3.5 PROTECTION

A. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 07720

SECTION 07840 - FIRESTOPPING

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 DEFINITIONS

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, cable, cable tray, conduit, piping, electrical busways and raceways through fire-rated vertical barriers (walls and partitions), horizontal barriers (floor/ceiling assemblies), and vertical service shaft walls and partitions.
   2. Safing slot gaps between edge of floor slabs and curtain walls.
   3. Openings between structurally separate sections of wall or floors.
   4. Gaps between the top of walls and ceilings or roof assemblies.
   5. Expansion joints in walls and floors.
   6. Openings and penetrations in fire-rated partitions or walls containing fire doors.
   7. Openings around structural members which penetrate floors or walls.

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 03300 - Cast-In-Place Concrete
   2. Section 04810 - Unit Masonry Assemblies
   3. Section 07210 - Building Insulation
   4. Section 07920 - Joint Sealants
   5. Section 09260 - Gypsum Board Assemblies
   6. Section 15000 - Mechanical
   7. Section 16000 - Electrical

1.5 REFERENCES

A. Test Requirements: ASTM E-814, "Standard Method of Fire Tests of Through Penetration Fire Stops" (July 1983).

B. Underwriters Laboratories (UL) of Northbrook, IL runs ASTM E-814 under their designation of UL 1479 and publishes the results in their "FIRE RESISTANCE DIRECTORY" that is updated annually with a midyear supplement.

C. UL Fire Resistance Directory:
1. Firestop Devices (XHJI)
2. Fire Resistance Ratings (BXUV)
3. Through-Penetration Firestop Systems (XHEZ)
4. Fill, Voids, or Cavity Material (XHHW)
5. Forming Materials (XHKU)
6. Alternate “Omega Point Laboratories Directory” (updated annually).
7. Test Requirements: UL 2079, “Tests for Fire Resistance of Building Joint Systems” (November 1994).
8. ASTM E-84, Standard Test Method for Surface Burning Characteristics of Building Materials.
9. All three major building codes: ICBO, SBCCI, and BOCA
10. NFPA 101 - Life Safety Code
11. NFPA 70 - National Electric 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, UL 1479 or UL 2079 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 any 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. Engineer judgment drawings must follow requirements set forth by the International Firestop Council (September 7, 1994).

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 1300.

B. Manufacturer's engineering judgment identification number and drawing details when no UL system is available for an application. Engineer 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 manufacture as having been provided the necessary training to install manufacture's products per specified requirements. A manufacture'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. Schedule installation of firestopping 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 manufacture 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 manufacture and approved by the qualified testing agency for the designated fire-resistance-rated systems.

C. Firestopping Materials are either “cast-in-place” (integral with concrete placement) or “post installed.” Provide cast-in-place firestop devices prior to concrete placement.

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 from one of the following manufacturers listed below; no substitutions will be accepted:

1. Hilti, Inc., Tulsa, Oklahoma: Phone - (800) 879-8000
2. Tremco Sealants & Coatings, Beachwood, Ohio: Phone - (216) 292-5000
3. 3M Fire Protection Products, St. Paul, Minnesota: Phone - (612) 736-0203

2.3 MATERIALS

A. Use only firestop products that have been UL 1479, ASTM E-814, or UL 2079 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. Cast-in place firestop devices for use with non-combustible and combustible plastic pipe (closed and open piping systems) penetrating concrete floors, the following products are acceptable:

1. Hilti CP 680 Cast-In Place Firestop Device

C. For penetrations by non-combustible items including steel pipe, copper pipe, rigid steel conduit and electrical metallic tubing (EMT), the following materials are acceptable:

1. Hilti FS 601 Elastomeric Firestop Sealant
2. Hilti FS-ONE High Performance Intumescent Firestop Sealant
3. Hilti CP 620 FireFoam
4. 3M Fire Stop Sealant 2000
5. 3M Fire Barrier CP25 WB
6. Tremco Tremstop Fyre-Sil Sealant

D. For fire-rated construction joints and other gaps, the following materials are acceptable:

1. Hilti FS 601 Elastomeric Firestop Sealant
2. Hilti CP 601s Elastomeric Firestop Sealant
3. Hilti CP 606 Flexible Firestop Sealant
4. Hilti CP 672 Firestop Joint Spray
5. Hilti CP 604 Self-leveling Firestop Sealant
6. 3M Firestop Sealant 2000
7. Tremco Tremstop Fyre-Sil Sealant

E. For penetrations by combustible items (penetrants consumed by high heat and flame) including insulated metal pipe, PVC jacketed, flexible cable or cable bundles and plastic pipe (closed piping systems), the following materials are acceptable:

1. Hilti FS-ONE High Performance Intumescent Firestop Sealant
2. Hilti CP 618 Firestop Putty
3. Hilti CP 642 Firestop Jacket
4. Hilti CP 643 Firestop Jacket
5. 3M Fire Barrier CP25 WB
6. 3M Fire Barrier FS-195 Wrap/Strip
7. Tremco Tremstop WBM Intumescent Firestop Sealant

F. For penetrations by combustible plastic pipe (open piping systems), the following materials are acceptable:

1. Hilti CP 642 Firestop Jacket
2. Hilti CP 643 Firestop Jacket
3. Hilti FS-ONE High Performance Intumescent Firestop Sealant
4. 3M Fire Barrier PPD Plastic Pipe Device

G. For large size/complex penetrations made to accommodate cable trays, multiple steel and copper pipes, electrical busways in raceways, the following materials are acceptable:

1. Hilti FS 635 Trowelable Firestop Compound
2. Hilti FIRE BLOCK
3. Hilti CP 620 FireFoam
4. 3M Firestop Foam 2001
5. 3M Fire Barrier CS-195 Composite Sheet

H. For openings between structurally separate sections of wall and floors. Top-of-walls, the following materials are acceptable:

1. Hilti FS 601 Elastomeric Firestop Sealant
2. Hilti CP 601s Elastomeric Firestop Sealant
3. Hilti CP 606 Flexible Firestop Sealant
4. Hilti FS-ONE High Performance Intumescent Firestop Sealant
5. 3M Fire Barrier CP 25 WB

I. Provide a firestop system with a "F" Rating as determined by UL 1479 or ASTM E814 which is equal to the time rating of construction being penetrated.

J. Provide a firestop system with an Assembly Rating as determined by UL 2079 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 published "Through-Penetration Firestop Systems" in UL's Fire Resistance Directory.

B. Manufacturer's Instructions: Comply with manufacturer's instructions for installation of through-penetration materials.

C. Seal all holes or voids made by penetrations to ensure an air and water resistant seal.

D. Consult with mechanical engineer, project manager prior to installation of UL firestop systems that might hamper the performance of fire dampers as it pertains to duct work.

E. 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. 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.

3.6 U.L. APPROVED SYSTEM SCHEDULES (SEE ATTACHED)

END OF SECTION 07840

SCHEDULES OF THROUGH PENETRATION FIRESTOP SYSTEMS

CONCRETE FLOORS		UL-CLASSIFIED SYSTEMS		
TYPE PENETRANT	**F-RATING**	**HILTI**	**3M**	**TREMCO**
CIRCULAR BLANK OPENINGS	1	FA 0006, CAJ 0070	CAJ 0009	CAJ 0011
	2	FA 0006, CAJ 0070	CAJ 0009	CAJ 0011
SINGLE METAL PIPES OR CONDUIT	1	CAJ 1226, CAJ 1382	CAJ 1058	CAJ 1064, CAJ 1302
	2	CAJ 1226, CAJ 1382	CAJ 1058	CAJ 1064, CAJ 1302
SINGLE NON-METALLIC PIPE OR CONDUIT (I.E. PVC, CPVC, ABS, ENT)	1	FA 2053, CAJ 2109, CAJ	CAJ 2189, CAJ 2117,	CAJ 2075, CAJ 2116, CAJ
	2	FA 2053, CAJ 2109, CAJ	CAJ 2189, CAJ 2117	CAJ 2075, CAJ 2116, CAJ
SINGLE OR BUNDLED CABLES	1	FA 3007, CAJ 3095, CAJ 3096	CAJ 3021	CAJ 3141
	2	FA 3007, CAJ 3095,CAJ 3096	CAJ 3021	CAJ 3141
CABLE TRAY	1	CAJ 4034, CAJ 4054	CAJ 4003	N/A*
	2	CAJ 4034, CAJ 4054	CAJ 4003	N/A*
ELECTRICAL BUSWAY	1	CAJ 6006, CAJ 6017	CAJ 6001, CAJ 6002	CAJ 6007
	2	CAJ 6006, CAJ 6017	CAJ 6001, CAJ 6002	CAJ 6007
SINGLE INSULATED PIPES	1	FA 5015, FA 5016, CAJ 5090, CAJ 5091, CAJ 5098	CAJ 5080, CAJ 5024, CAJ 5017	CAJ 5111, CAJ 5121
	2	FA 5015, FA 5016, CAJ 5090, CAJ 5091, CAJ 5098	CAJ 5080, CAJ 5024, CAJ 5017	CAJ 5111, CAJ 5121
NON-INSULATED MECHANICAL DUCTWORK WITHOUT DAMPERS	1	CAJ 7046 CAJ 7051	CAJ 7003, CAJ 7021	CAJ 7005, CAJ 7044
	2	CAJ 7046 CAJ 7051	CAJ 7003, CAJ 7021	CAJ 7005, CAJ 7044
MIXED PENETRANTS	1	CAJ 8041, CAJ	CAJ 8001, CAJ	CAJ 8057
	2	CAJ 8041, CAJ 8056, CAJ 8096	CAJ 8001, CAJ 8013	CAJ 8057

* No UL-Classified systems for this manufacturer. Engineer Judgement Drawing Required

SCHEDULES OF THROUGH PENETRATION FIRESTOP SYSTEMS

CONCRETE OR BLOCK WALLS		UL-CLASSIFIED SYSTEMS		
TYPE PENETRANT	**F-RATING**	**HILTI**	**3M**	**TREMCO**
CIRCULAR BLANK OPENINGS	1	CAJ 0055, CAJ 0070	CAJ 0009	CAJ 0011
	2	CAJ 0055, CAJ 0070	CAJ 0009	CAJ 0011
SINGLE METAL PIPES OR CONDUIT	1	CAJ 1226, WJ 1021	CAJ 1058	CAJ 1064, CAJ 1302
	2	CAJ 1226, WJ 1021	CAJ 1058	CAJ 1064, CAJ 1302
SINGLE NON-METALLIC PIPE OR CONDUIT (I.E. PVC, CPVC, ABS, ENT)	1	CAJ 2109, CAJ 2098	CAJ 2189, CAJ 2117, CAJ 2027	CAJ 2075, CAJ 2116, CAJ 2229
	2	CAJ 2109, CAJ 2098	CAJ 2189, CAJ 2117, CAJ 2027	CAJ 2075, CAJ 2116, CAJ 2229
SINGLE OR BUNDLED CABLES	1	WJ 3036, CAJ 3095,	CAJ 3021	CAJ 3141
	2	WJ 3036, CAJ 3095, CAJ 3096	CAJ 3021	CAJ 3141
CABLE TRAY	1	WJ 4016, CAJ 4034,	CAJ 4003	WJ 4012
	2	WJ 4016, CAJ 4034, CAJ 4054	CAJ 4003	WJ 4012
SINGLE INSULATED PIPES	1	CAJ 5090, CAJ 5091, CAJ 5061	CAJ 5080, CAJ 5024, CAJ 5017	CAJ 5111, CAJ 5121
	2	CAJ 5090, CAJ 5091, CAJ 5061	CAJ 5080, CAJ 5024, CAJ 5017	CAJ 5111, CAJ 5121
ELECTRICAL BUSWAY	1	CAJ 6006, CAJ 6017	CAJ 6001, CAJ 6002	CAJ 6007
	2	CAJ 6006, CAJ 6017	CAJ 6001, CAJ 6002	CAJ 6007
NON-INSULATED MECHANICAL DUCTWORK WITHOUT DAMPERS	1	CAJ 7046, CAJ 7051, WJ 7021, WJ 7022	CAJ 7003, CAJ 7021	CAJ 7005, CAJ 7044
	2	CAJ 7046, CAJ 7051, WJ 7021, WJ 7022	CAJ 7003, CAJ 7021	CAJ 7005, CAJ 7044
MIXED PENETRANTS	1	CAJ 8041, CAJ 8096, WJ 8007	CAJ 8001, CAJ 8013	CAJ 8057
	2	CAJ 8041, CAJ 8096, WJ 8007	CAJ 8001, CAJ 8013	CAJ 8057

* No UL-Classified systems for this manufacturer. Engineer Judgement Drawing Required

SCHEDULES OF THROUGH PENETRATION FIRESTOP SYSTEMS

WOOD FLOORS		UL-CLASSIFIED SYSTEMS		
TYPE PENETRANT	**F-RATING**	**HILTI**	**3M**	**TREMCO**
METAL PIPES OR CONDUIT	1	FC 1009, FC 1059	FC 1002	FC 1050, FC 1054
	2	FC 1009, FC 1059	FC 1002	N/A*
NON-METALLIC PIPE OR CONDUIT	1	FC 2025, FC 2030	FC 2024	FC 2049, FC 2135
	2	FC 2025, FC 2029	FC 2024	FC 2049, FC 2083
WOOD FLOORS		**UL-CLASSIFIED SYSTEMS**		
TYPE PENETRANT	**F-RATING**	**HILTI**	**3M**	**TREMCO**
SINGLE OR BUNDLED CABLES	1	FC 3012, FC 3044	FC 3017	FC 3037
	2	FC 3012	FC 3017	N/A*
INSULATED PIPES	1	FC 5004, FC 5036, FC 5037	FC 5014	FC 5055
	2	FC 5004, FC 5036,	N/A*	N/A*
NON-INSULATED MECHANICAL DUCTWORK WITHOUT DAMPERS	1	FC 7013	FC 7001	N/A*
MIXED PENETRANTS	1	FC 8009. FC 8014	FC 8013	N/A*
	2	N/A*	N/A*	N/A*

* No UL-Classified systems for this manufacturer. Engineer Judgement Drawing Required

SCHEDULES OF THROUGH PENETRATION FIRESTOP SYSTEMS

GYPSUM WALLBOARD		UL-CLASSIFIED SYSTEMS		
TYPE PENETRANT	**F-RATING**	**HILTI**	**3M**	**TREMCO**
METAL PIPES OR CONDUIT	1	WL 1054, WL 1058, WL 1164	WL 1146	WL 1158
	2	WL 1054, WL 1058, WL 1164	WL 1010, WL 1146	WL 1019, WL 1020, WL 1158
NON-METALLIC PIPE OR CONDUIT	1	WL 2078, WL 2075, WL	WL 2088, WL 2002	WL 2083, WL 2129
	2	WL 2078, WL 2075, WL 2128	WL 2088, WL 2002	WL 2063, WL 2129, WL 2159
SINGLE OR BUNDLED CABLES	1	WL 3065, WL 3111, WL3112	WL 3032, WL 3030	WL 3131
	2	WL 3065, WL 3111, WL 3112	WL 3032, WL 3030	WL 3017, WL 3131
CABLE TRAY	1	WL 4011, WL 4019, WL4054	WL 4004	N/A*
	2	WL 4011, WL 4019, WL4054	WL 4004	WL 4012
INSULATED PIPES	1	WL 5028, WL 5029, WL 5047	WL 5040, WL 5001, WL 5032	WL 5070, WL 5081
	2	WL 5028, WL 5029, WL 5047	WL 5040, WL 5001, WL 5032	WL 5070, WL 5081
NON-INSULATED MECHANICAL DUCTWORK WITHOUT DAMPERS	1	WL 7017, WL 7040, WL 7042	WL 7008	WL 7039
	2	WL 7040, WL 7042	WL 7008, WL 7013, WL 7016	WL 7039
MIXED PENETRANTS	1	WL 1095, WL 8013	WL 8010	N/A*
	2	WL 1095, WL 8013	WL 8010, WL	N/A*

* No UL-Classified systems for this manufacturer. Engineer Judgement Drawing Required

NOTES:

1. Jobsite conditions of each through-penetration firestop system must meet ALL details of the UL-Classified System selected.

2. If jobsite conditions do not match any UL-classified systems in the schedules above, contact firestop manufacturer for alternative systems or Engineer Judgement Drawings.

3. Where more than one applicable UL-Classified System is listed in the schedules, choose the UL System which is most economical for each through-penetration firestop system.

4. Coordinate work with other trades to assure that penetration opening sizes are appropriate for penetrant locations, and vice versa.

5. For 3-hour rated gypsum walls, contact the firestop manufacturer for a UL-classified system or engineer judgement drawing.

SECTION 07900 - JOINT SEALERS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes joint sealants for the following applications, including those specified by reference to this Section.

1. Exterior joints in the following vertical surfaces and horizontal nontraffic surfaces:
   a. Joints between plant-precast architectural concrete units.
   b. Control and expansion joints in unit masonry.
   c. Joints between different materials listed above.
   d. Perimeter joints between materials listed above and frames of doors, windows, storefront, curtainwall, and, louvers.
   e. Other joints as indicated or required to impart a neat and weathertight condition.
2. Exterior joints in the following horizontal traffic surfaces:
   a. Control and expansion joints in brick pavers.
   b. Isolation and contraction joints in cast-in-place concrete slabs.
   c. Joints in stone paving units, including steps.
   d. Joints between different materials listed above.
   e. Other joints as indicated or required to impart a neat and weathertight condition.
3. Interior joints in the following vertical surfaces and horizontal nontraffic surfaces:
   a. Control and expansion joints on exposed interior surfaces of exterior walls.
   b. Perimeter joints of exterior openings where indicated.
   c. Tile control and expansion joints.
   d. Vertical joints on exposed surfaces of interior unit masonry, concrete, walls, and, partitions.
   e. Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances.
   f. Joints between plumbing fixtures and adjoining walls, floors, and counters.
   g. Other joints as indicated or required to impart a neat and finished appearance.
4. Interior joints in the following horizontal traffic surfaces:
   a. Isolation joints in cast-in-place concrete slabs.
   b. Control and expansion joints in tile flooring.
   c. Other joints as indicated or required to impart a neat and finished appearance.

1.2 RELATED REQUIREMENTS

A. Section 01616 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 07840 - Firestopping: Firestopping sealants.

C. Section 08800 - Glazing: Glazing sealants and accessories.

D. Section 09260 - Gypsum Board Assemblies: Acoustic sealant.

E. Section 09300 - Tile: Sealant used as tile grout.

1.3 REFERENCE STANDARDS

A. ASTM C 834 - Standard Specification for Latex Sealants; 2010.

B. ASTM C 919 - Standard Practice for Use of Sealants in Acoustical Applications; 2008.

C. ASTM C 1193 - Standard Guide for Use of Joint Sealants; 2009.

1.4 PERFORMANCE REQUIREMENTS

A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

B. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

1.5 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data indicating sealant chemical characteristics.

C. Samples: Submit two samples, 6 inch long in size illustrating sealant colors for selection.

D. LEED Report: Submit VOC content documentation for all non-preformed sealants and primers.

E. SWRI Validation Certificate: For each elastomeric sealant specified to be validated by SWRI's Sealant Validation Program.

F. Product Test Reports: Based on comprehensive testing of product formulations performed by a qualified testing agency, indicating that sealants comply with requirements.

G. Warranties: Special warranties specified in this Section.

H. Manufacturer's Installation Instructions: Indicate special procedures.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

B. Product Testing: Obtain test results for "Product Test Reports" Paragraph in "Submittals" Article from a qualified testing agency based on testing current sealant formulations within a 36-month period preceding the Notice to Proceed with the Work.

1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated, as documented according to ASTM E 548.
2. Test elastomeric joint sealants for compliance with requirements specified by reference to ASTM C 920, and where applicable, to other standard test methods.
3. Test elastomeric joint sealants according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C 920 for adhesion and cohesion under cyclic movement, adhesion-in-peel, and indentation hardness.
4. Test other joint sealants for compliance with requirements indicated by referencing standard specifications and test methods.

1.7 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

1.8 WARRANTY

A. See Section 01780 - Closeout Submittals, for additional warranty requirements.

B. Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

C. Special Manufacturer's Warranty: Manufacturer's standard form in which elastomeric sealant manufacturer agrees to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: 10 years from date of Substantial Completion.

D. Special warranties specified in this Article exclude deterioration or failure of elastomeric joint sealants from the following:

1. Movement of the structure resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression caused by structural settlement or errors attributable to design or construction.
2. Disintegration of joint substrates from natural causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Sealants:
1. Bostik Inc: www.bostik-us.com.
2. Tremco Global Sealants: www.tremcosealants.com.
3. Pecora Corporation: www.pecora.com.
4. BASF Construction Chemicals-Building Systems: www.chemrex.com.
5. Substitutions: See Section 01600 - Product Requirements.

2.2 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.

B. Colors of Exposed Joint Sealants: Custom formulations that match the color of brick mortar, precast concrete, and aluminum windows painted finish.

2.3 ELASTOMERIC JOINT SEALANTS

A. Elastomeric Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

B. Stain-Test-Response Characteristics: Where elastomeric sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

C. Suitability for Immersion in Liquids. Where elastomeric sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247 and qualify for the length of exposure indicated by reference to ASTM C 920 for Class 1 or 2. Liquid used for testing sealants is deionized water, unless otherwise indicated.

D. Single-Component Neutral-Curing Silicone Sealant:
1. Products (Class 100/50):
   a. Dow Corning Corporation; 790.
   b. GE Silicones; SilPruf LM SCS2700.
2. Products (Class 50):
   a. Dow Corning Corporation; 795
   b. GE Silicones; SilPruf NB SCS9000.
   c. GE Silicones; UltraPruf II SCS2900.
   d. Pecora Corporation; 865.
   e. Pecora Corporation; 895.
   f. Pecora Corporation; 898.
3. Type and Grade: S (single component) and NS (nonsag).
4. Class: 50 and 100/50.

5. Use Related to Exposure: NT (nontraffic).
6. Uses Related to Joint Substrates: M, G, A, and, as applicable to substrates indicated, O.
   a. Use O Joint Substrates, Class 100/50: brick and precast concrete.
   b. Use O Joint Substrates, Class 50: color anodic aluminum, aluminum coated with a high-performance coating, galvanized steel, and stainless steel.
7. Stain-Test-Response Characteristics: Nonstaining to porous substrates per ASTM C 1248.

E. Single-Component Mildew-Resistant Neutral-Curing Silicone Sealant:
   1. Products:
      a. Pecora Corporation; 898.
      b. Tremco; Tremsil 600 White.
   2. Type and Grade: S (single component) and NS (nonsag).
   3. Class: 25.
   4. Use Related to Exposure: NT (nontraffic).
   5. Uses Related to Joint Substrates: G, A, and, as applicable to joint substrates indicated, O.
      a. Use O Joint Substrates: porcelain plumbing fixtures.

F. Multicomponent Nonsag Urethane Sealant:
   1. Products:
      a. Schnee-Morehead, Inc.; Permathane SM 7200.
      b. Sika Corporation, Inc.; Sikaflex - 2c NS TG.
      c. Sonneborn, Division of ChemRex Inc.; NP 2.
      d. Tremco; Vulkem 227.
      e. Tremco; Vulkem 322 DS.
   2. Type and Grade: M (multicomponent) and NS (nonsag).
   3. Class: 25.
   4. Uses Related to Exposure: T (traffic) and NT (nontraffic).
   5. Uses Related to Joint Substrates: M, A, and, to joint substrates indicated, O.
      a. Use O Joint Substrates: brick pavers, stone pavers, concrete pavements. ceramic wall and floor tile.

G. Single-Component Nonsag Urethane Sealant:
   1. Products:
      a. Sika Corporation, Inc.; Sikaflex - 1a.
      b. "Sikaflex - 15LM" below is classified by manufacturer as a Class 100/50 sealant; other products are Class 25.
      c. Sonneborn, Division of ChemRex Inc.; NP 1.
      d. Tremco; Vulkem 116.
   2. Type and Grade: S (single component) and NS (nonsag).
   3. Class: 25.
   4. Uses Related to Exposure: T (traffic) and NT (nontraffic).
   5. Uses Related to Joint Substrates: M, A, and, to joint substrates indicated, O.
      a. Use O Joint Substrates: All concealed wall cavity sealant locations.

2.4 LATEX JOINT SEALANTS

A. Latex Sealant: Comply with ASTM C 834, Type OP, Grade NF.

B. Products:
1. Bostik Findley; Chem-Calk 600.
2. Pecora Corporation; AC-20+.
3. Schnee-Morehead, Inc.; SM 8200.
4. Sonneborn, Division of ChemRex Inc.; Sonolac.
5. Tremco; Tremflex 834.

2.5 ACOUSTICAL JOINT SEALANTS

A. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 and the following:
1. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
2. Products:
a. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.
b. United States Gypsum Co.; SHEETROCK Acoustical Sealant.

B. Acoustical Sealant for Concealed Joints: Manufacturer's standard, nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant recommended for sealing interior concealed joints to reduce airborne sound transmission.
1. Products:
a. Pecora Corporation; BA-98.
b. Tremco; Tremco Acoustical Sealant.

2.6 FOAMED-IN-PLACE SEALANT

A. General: Provide expanding foam sealant where indicated on the drawings that is non- staining; are compatible with joint substrates and sealants; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Foamed-in-Place Sealant: Equal to Emsal "Backerseal".

2.7 JOINT-SEALANT BACKING

A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, Type O (open-cell material), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self- adhesive tape where applicable.

2.8 ACCESSORIES

A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.

B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

C. Joint Backing: Round foam rod compatible with sealant; ASTM D 1667, closed cell PVC; oversized 30 to 50 percent larger than joint width.

D. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

E. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 - EXECUTION

3.1 EXAMINATION

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

B. Verify that joint backing and release tapes are compatible with sealant.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil- free compressed air. Porous joint substrates include the following:
    a. Concrete.
    b. Masonry.
    c. Unglazed surfaces of ceramic tile.
    d. Precast Concrete
3. Remove laitance and form-release agents from concrete.
4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
    a. Metal.
    b. Glass.
    c. Porcelain enamel.
    d. Porcelain toilet fixtures.
    e. Glazed surfaces of ceramic tile.
    f. Stainless Steel.

B. Joint Priming: Prime joint substrates, where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION

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 C 1193.

C. Acoustical Sealant Application Standard: Comply with recommendations in ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.

D. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

E. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

F. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

G. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.

H. Installation of Preformed Silicone-Sealant System: Comply with the following requirements:

1. Apply masking tape to each side of joint, outside of area to be covered by sealant system.
2. Apply silicone sealant to each side of joint to produce a bead of size complying with preformed silicone-sealant system manufacturer's written instructions and covering a bonding area of not less than 3/8 inch. Hold edge of sealant bead 1/4 inch inside masking tape.
3. Within 10 minutes of sealant application, press silicone extrusion into sealant to wet extrusion and substrate. Use a roller to apply consistent pressure and ensure uniform contact between sealant and both extrusion and substrate.

3.4 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION 07900

SECTION 08110 - STEEL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Non-fire-rated steel doors and frames.

B. Steel frames for wood doors.

C. Fire-rated steel doors and frames.

D. Thermally insulated steel doors.

E. Steel glazing frames.

F. Accessories, including glazing, louvers, and matching panels.

1.2 RELATED REQUIREMENTS

A. 08211 - Flush Wood Doors.

B. Section 08710 - Door Hardware.

C. Section 08800 - Glazing: Glass for doors and borrowed lites.

D. Section 09900 - Paints and Coatings: Field painting.

1.3 REFERENCE STANDARDS

A. ANSI/ICC A117.1 - American National Standard for Accessible and Usable Buildings and Facilities; International Code Council; 2003.

B. ANSI A250.3 - Test Procedure and Acceptance Criteria for Factory-Applied Finish Painted Steel Surfaces for Steel Doors and Frames; 2007.

C. National Fire Protection Association (NFPA):
1. NFPA 80, "Standard for Fire Doors and Windows" (copyrighted by NFPA, ANSI approved).

D. Steel Door Institute (S.D.I.):
1. S.D.I.-111-C, "Recommended Louver Details for Standard Steel Doors."
2. S.D.I.-112, "Galvanized Standard Steel Doors and Frames."
3. S.D.I.-117, "Manufacturing Tolerances Standard Steel Doors and Frames."
4. S.D.I.-119, "Performance Test Procedures for Steel Door Frames and Frame Anchors" (copyrighted by S.D.I., ANSI approved).

E. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2009a.

F. ASTM C 1363 - Standard Test Method for Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus; 2005.

G. ASTM E 1408 - Standard Test Method for Laboratory Measurement of the Sound Transmission Loss of Door Panels and Door Systems; 1991 (Reapproved 2000).

H. BHMA A156.115 - Hardware Preparation in Steel Doors and Steel Frames; 2006.

I. NAAMM HMMA 840 - Guide Specifications for Installation and Storage of Hollow Metal Doors and Frames; The National Association of Architectural Metal Manufacturers; 2007.

J. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2010.

K. UL (BMD) - Building Materials Directory; Underwriters Laboratories Inc.; current edition.

L. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

1.4 SYSTEM DESCRIPTION

A. Performance Requirements: Provide steel doors and frames that satisfy the following:
1. Swing Door: ANSI A151.1, minimum 1,000,000 cycles (open and closing).
2. Door Twist: ANSI A151.1.
3. Frame: S.D.I.-119, 1,000,000 cycles (open and closing).
4. Structural: Doors and frames, ASTM E 330, 75 psf inswing and outswing.

1.5 SUBMITTALS

A. See Section 01300 - Administrative Requirements for submittal procedures.

B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced grade standard.

C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and identifying location of different finishes, if any.

D. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.

E. Qualification Data: Submit qualification data for firms and persons specified in Quality Assurance Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names of architects and owners, and other information specified.

F. Oversize Construction Certification: For door assemblies required to be fire-rated and exceeding limitations of labeled assemblies, submit certification of an inspecting and testing agency acceptable to authorities having jurisdiction that each door and frame assembly has been constructed to conform to design, materials, and construction equivalent to requirements for labeled construction.

G. Manufacturer's Certificate: Certification that products meet or exceed specified requirements.

1.6 QUALITY ASSURANCE

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

B. Regulatory Requirements: Comply with applicable requirements of the laws, codes, ordinances, and regulations of Federal, State, and local authorities having jurisdiction. Obtain necessary approvals from such authorities.

C. Steel Door and Frame Standards: Provide doors and frames complying with ANSI A250.8 and as herein specified.

D. Fire-Rated Door Assemblies: Provide units that comply with NFPA 80, are identical to door and frame assemblies whose fire resistance characteristics have been determined per ASTM E 152 and which are labeled and listed by UL, Factory Mutual Research Corp. (FM), Intertek Testing Services (ITS), or other inspecting and testing agency acceptable to authorities having jurisdiction.

1. Oversized Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide manufacturer's certification that doors conform to standard construction requirements of tested and labeled fire-rated door assemblies except for size.
2. Temperature Rise Rating: At stairwell enclosures, provide doors which have temperature rise rating of 450 °F maximum in 30 minutes of fire exposure.
3. Test Pressure: Test at positive pressure per UL 10C.
4. Single Source Responsibility: Provide steel doors and frames manufactured by a single firm specializing in the production of this type of work, unless otherwise acceptable to the Architect.

E. Maintain at the project site a copy of all reference standards dealing with installation.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store in accordance with NAAMM HMMA 840.

B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Steel Doors and Frames:
1. Assa Abloy Ceco, Curries, or Fleming: www.assaabloydss.com.
2. Windsor Republic Doors; Product: www.republicdoor.com.
3. Steelcraft: www.steelcraft.com.
4. MPI Group
5. Substitutions: See Section 01600 - Product Requirements.

2.2 DOORS AND FRAMES

A. Requirements for All Doors and Frames:
1. Accessibility: Comply with ANSI/ICC A117.1.
2. Door Top Closures: Flush with top of faces and edges.
3. Door Edge Profile: Beveled on both edges.
4. Door Texture: Smooth faces.
5. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings.

6. Glazed Lights in Fire-rated Walls: Provide gasketed glazing stops as required by NFPA 80 to meet fire-rating requirements.
7. Hardware Preparation: In accordance with BHMA A156.115, with reinforcement welded in place, in addition to other requirements specified in door grade standard.
8. Galvanizing for Units in Wet Areas: All components hot-dipped zinc-iron alloy-coated (galvannealed), manufacturer's standard coating thickness.
9. Finish: Factory primed, for field finishing.

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

2.3 MATERIALS

A. Hot-Rolled Steel Sheet: ASTM A 569, commercial quality, pickled and oiled, free of scale, pitting, or surface defects.

B. Cold-Rolled Steel Sheet: Provide carbon steel complying with ASTM A 366, commercial quality, or ASTM A 620, drawing quality, special killed.

C. Galvanized Steel Sheets: Provide zinc-coated carbon steel complying with ASTM A 653, commercial quality or drawing quality, hot-dip galvanized according to ASTM A 924, with A60 or G60 coating designation, mill-phosphatized.

D. Supports and Anchors: Unless otherwise specified, provide supports and anchors as follows:
1. For Uncoated Frames: Fabricate of not less than 0.0478 inch thick (18 gage) uncoated sheet steel.
2. For Coated Frames: Fabricate of not less than 0.0598 inch thick (16 gage) sheet metal. Units to be built into exterior walls or where used with galvanized frames shall be hot- dip galvanized after fabrication in compliance with ASTM A 153, Class B.

E. Inserts, Bolts, and Fasteners: Provide manufacturer's standard units. Where items are to be built into exterior walls, hot-dip galvanize in compliance with ASTM A 153, Class C or Class D as applicable.

F. Wood Doors: See Section 08211 - WOOD DOORS.

G. Hardware: See Section 08710 - DOOR HARDWARE.

H. Glass and Glazing Materials: See Section 08800 - GLAZING.

2.4 STEEL DOORS

A. Exterior Doors:

1. Comply with ANSI A250.8, Level 3, extra heavy duty, Model 2, seamless design, minimum 0.0635 inch thick (16 gage) galvanized steel sheet faces.

2. Fabricate exterior doors of two outer, galvanized, stretcher-leveled steel sheets. Construct doors with smooth, flush surfaces without visible joints or seams on exposed faces or stile edges, except around glazed or louvered panel inserts. Provide weephole openings in the bottom of doors to permit escape of entrapped moisture. Close bottom edge with minimum 0.0635 inch thick (16 gage) galvanized steel closing channel and top edge with minimum 0.0635 inch thick (16 gage) galvanized steel filler channel so webs of channels are flush with bottom and top edges. Seal joints in top edges of doors against water penetration.

3. Reinforce inside of doors with vertical galvanized sheet steel sections not less than 0.0336 inch thick (22 gage). Space vertical reinforcing 6 inches on center and extend full door height. Spot weld at not more than 6 inches on center to both face sheets.

   a. Continuous truss form inner core of 0.0187 inch thick (28 gage) galvanized sheet steel reinforcing may be provided as inner reinforcement, in lieu of above. Spot weld truss form reinforcement 3 inches on center vertically and horizontally over entire surface of both sides.

   b. Reinforce tops and bottoms of doors with 0.0635 inch thick (16 gage) horizontal galvanized steel channels spot-welded maximum 6 inches on center to outer sheets. Close top and bottom edges to provide flush, waterproof weather seal, as integral part of door construction or by adding inverted galvanized steel channels at least 0.0635 inch thick (16 gage).

4. Core: Polystyrene foam.

5. Galvanizing: All components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A 653/A 653M, with manufacturer's standard coating thickness.

6. Insulating Value: U-value of 0.50, when tested in accordance with ASTM C 1363.

7. Weather stripping: Separate, see Section 08710.

B. Interior Doors, Non-Fire-Rated:

1. Comply with ANSI A250.8, Level 2, heavy duty, Model 2, seamless design, minimum 0.0478 inch thick (18 gage) cold-rolled steel sheet faces.

2. Fabricate interior doors of two outer, cold-rolled, stretcher-leveled steel sheets. Construct doors with smooth, flush surfaces, without visible joints or seams on exposed faces or stile edges, except around glazed or louvered panel inserts.

3. Reinforce inside of doors with vertical, hot-rolled, not less than 0.0299 inch thick (22 gage) steel sections. Space vertical reinforcing 6 inches on center and extend full door height. Spot weld at not more than 6 inches on center to both face sheets.

   a. Continuous truss form inner core of 0.0149 inch thick (28 gage) sheet metal reinforcing may be provided as inner reinforcement in lieu of above. Spot weld truss form reinforcement 3 inches on center vertically and horizontally over entire surface of both sides.

   b. Reinforce tops and bottoms of doors with 0.0478 inch thick (18 gage) horizontal steel channels spot-welded maximum 6 inches on center to outer sheets.

C. Interior Doors, Fire-Rated:

1. Fire Rating: As indicated on Door and Frame Schedule, tested in accordance with UL 10C ("positive pressure").

   a. Provide units listed and labeled by UL.

   b. Attach fire rating label to each fire rated unit.

D. Panels: Same construction, performance, and finish as doors.

E. Finish Hardware Reinforcement: Comply with ANSI A250.8, except as otherwise indicated. Provide minimum gages of steel reinforcing plates for the following hardware:

1. Hinges and Pivots: 0.1793 inch thick (7 gage) by 1-1/2 inches wide by 6 inches longer than hinge, secured by not less than six spot welds.
2. Lock Face, Flush Bolts, Closers, and Concealed Holders: 0.1046 inch thick (12 gage).
3. Other Surface-Mounted Hardware: 0.0598 inch thick (16 gage).

2.5 STEEL FRAMES

A. General:

1. Comply with the requirements of grade specified for corresponding door.
2. Finish: Same as for door.
3. Provide mortar guard boxes for hardware cut-outs in frames to be installed in masonry or to be grouted.

B. Frames: Provide metal frames for doors, transoms, and other openings, of types and styles as shown on the Drawings and schedules. Conceal fastenings, unless otherwise indicated.

1. Fabricate frames of full-welded unit construction, with corners mitered, reinforced, continuously welded full depth and width of frame. Knock-down type frames are not acceptable.
2. Form interior frames of either cold-rolled or hot-rolled sheet steel of the following minimum gages:
   a. Openings Up to and Including 4 Feet Wide: 0.0598 inch thick (16 gage).
   b. Openings Over 4 Feet Wide: 0.0747 inch thick (14 gage).
3. Form exterior frames from 0.0785 inch thick (14 gage) galvanized steel.

C. Finish Hardware Reinforcement: Fabricate from same material as frame. Comply with ANSI A250.8, except as otherwise indicated. Provide minimum gages of steel reinforcing plates for the following hardware:

1. Hinges and Pivots: 0.1793 inch thick (7 gage) by 1-1/2 inches wide by 6 inches longer than hinge, secured by not less than six spot welds.
2. Strikes, Flush Bolts, and Closers: 0.1046 inch thick (12 gage).
3. Surface-Mounted Hold-Open Arms and Panic Devices: 0.1046 inch thick (12 gage).

D. Mullions and Transom Bars: Provide closed or tubular mullions and transom bars where indicated. Fasten mullions and transom bars at crossings and to jambs by butt welding. Reinforce joints between frame members with concealed clip angles or sleeves of same metal and thickness as frame. Provide false head member to receive lower ceiling where frames extend to finish ceilings of different heights.

E. Supports and Anchors: After fabricating, galvanize units to be built into exterior walls in compliance with ASTM A 153, Class B.

1. Jamb Anchors: Weld jamb anchors to frames near hinges and directly opposite on strike jamb as required to secure frames to adjacent construction, formed of not less than 0.0516 inch thick (18 gage) galvanized steel.

a. Masonry Construction: Adjustable, flat, corrugated, or perforated, T-shaped to suit frame size, with leg not less than 2 inches wide by 10 inches long. Furnish at least three anchors per jamb up to 7-1/2 feet height, four anchors up to 8 feet jamb height, and one additional anchor for each 24 inches or fraction thereof over 8 feet height.

b. Wood Stud Partitions: Insert type with notched clip to attach to wood stud, welded to back of frames. Provide at least four anchors for each jamb for frames up to 7- 1/2 feet in height, five anchors up to 8 feet jamb height, and one additional anchor each 24 inches or fraction thereof over 8 feet height.

c. In-Place Concrete or Masonry: Anchor frame jambs with minimum 3/8 inch concealed bolts into expansion shields or inserts at 6 inches from top and bottom and 26 inches on center, unless otherwise shown. Reinforce frames at anchor locations. Except for fire-rated openings, apply removable stop to cover anchor bolts unless otherwise indicated.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, formed of not less than 0.0785 inch thick (14 gage) galvanized steel sheet, as follows:

a. Monolithic Concrete Slabs: Clip type anchors, with two holes to receive fasteners, welded to bottom of jambs and mullions.

b. Separate Topping Concrete Slabs: Adjustable type with extension clips, allowing not less than 2 inch height adjustment. Terminate bottom of frames at finish floor surface.

3. Head Anchors: Provide two anchors at head of frames exceeding 42 inches wide for frames mounted in steel stud walls.

4. Head Strut Supports: Provide 3/8 inch by 2 inch vertical steel struts extending from top of frame at each jamb to supporting construction above, unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction above. Provide adjustable wedged or bolted anchorage to frame jamb members.

F. Structural Reinforcing Members: Provide as part of frame assembly, where indicated at mullions, transoms, or other locations that are to be built into frame.

G. Head Reinforcement:

1. Where installed in masonry, leave vertical mullions in frames open at top for grouting.

2. For frames over 4 feet wide in masonry wall openings, provide continuous steel channel or angle stiffener, not less than 0.1046 inch thick (12 gage) for full width of opening, welded to back of frame at head.

H. Spreader Bars: Provide removable spreader bar across bottom of frames, tack-welded to jambs and mullions.

I. Door Silencers: Except on weather stripped frames, drill stops to receive three silencers on strike jambs of single-door frames and two silencers on heads of double-door frames. Install plastic plugs to keep holes clear during construction.

J. Plaster Guards: Provide minimum 0.0179 inch thick (26 gage) steel plaster guards or mortar boxes, welded to frame, at back of hardware cutouts where mortar or other materials might obstruct hardware operation and to close off interior of openings.

2.6 LOUVERS

A. Door Louvers: Provide louvers according to S.D.I.-111-C for interior doors where indicated, with blades or baffles formed of 0.0239 inch thick (24 gage) cold-rolled steel sheet set into minimum 0.0359 inch thick (20 gage) steel frame. Fabricate louvers and mount flush into doors without overlapping moldings on surface of door facing sheets.

1. Sightproof Louvers: Stationary louvers constructed with inverted V-shaped or Y-shaped blades.
2. Internal Support: Provide internal support as recommended by louver manufacturer. Prime paint after fabrication, except stainless steel.

2.7 STOPS AND MOLDINGS

A. Provide stops and moldings around solid, glazed, and louvered panels where indicated.

B. Form fixed stops and moldings integral with frame, unless otherwise indicated.

C. Provide removable stops and moldings on inside of glass, louvers, and other panels in doors, and where indicated or required, formed of not less than 0.0359 inch thick (20 gage) steel sheets matching steel of frames. Secure with countersunk flat or oval head machine screws spaced uniformly not more than 12 inches on center. Form corners with butted hairline joints.

D. Provide non-removable stops and moldings on outside of exterior doors and on secure side of interior doors for glass, louvers, and other panels in doors.

E. Coordinate width of rabbet between fixed and removable stops with type of glass or panel and type of installation indicated.

2.8 ACCESSORY MATERIALS

A. Glazing: As specified in Section 08800, factory installed.

B. Astragals for Double Doors: Specified in Section 08710.

1. Fire-Rated Doors: Steel, shape as required to accomplish fire rating.

C. Grout for Frames: Portland cement grout of maximum 4-inch 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 all factory- or shop-assembled frames.

2.9 FABRICATION

A. General: Fabricate steel door and frame units to be rigid, neat in appearance and free from defects, warp, or buckle. Accurately form metal to required sizes and profiles. Wherever practicable, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory-assembled before shipment, to assure proper assembly at the Project site. Weld exposed joints continuously, and grind, fill, dress, and make smooth, flush, and invisible. Comply with ANSI A250.8 requirements.

B. Internal Construction: Provide manufacturer's standard core materials according to S.D.I. standards.

C. Exposed Faces: Fabricate exposed faces of doors and panels, including, but not limited to, stiles and rails of non-flush units, from only cold-rolled steel.

D. Tolerances: Comply with S.D.I.-117.

E. Materials: Fabricate frames, concealed stiffeners, reinforcement, edge channels, louvers and moldings from either cold-rolled or hot-rolled steel. At exterior locations and where indicated, fabricate doors, panels, and frames from galvanized steel sheet according to S.D.I.- 112. Close top and bottom edges of doors flush as an integral part of door construction or by addition of minimum 0.0635 inch thick (16 gage) galvanized steel channels, with channel webs placed even with top and bottom edges. Seal joints in top edges of doors against water penetration.

F. Exposed Fasteners: Unless otherwise indicated, provide countersunk flat or oval heads for exposed screws and bolts.

G. Thermal-Rated (Insulating) Assemblies: At exterior locations and elsewhere as shown or scheduled, provide doors fabricated as thermal insulating door and frame assemblies and tested in accordance with ASTM C 976 on fully operable door assemblies.

1. Unless otherwise indicated, provide thermal-rated assemblies with U-value rating of 0.30 Btu per square foot per hour per degree fahrenheit.

H. Sound-Rated (Acoustical) Assemblies: Where shown or scheduled, provide door and frame assemblies fabricated as sound-reducing type, tested according to ASTM E 1408, and classified in accordance with ASTM E 413.

1. Unless otherwise indicated, provide acoustical assemblies with sound ratings of STC 33 or better.

I. Hardware Preparation: Prepare doors and frames to receive mortised and concealed hardware in accordance with final door hardware schedule and templates provided by hardware supplier. Comply with applicable requirements of ANSI A250.6, ANSI A115 standards, and ANSI A115.IG for door and frame preparation for hardware.

1. For concealed overhead door closers, provide space, cutouts, reinforcing and provisions for fastening in top rail of doors or head of frames, as applicable.
2. Reinforce doors and frames to receive surface-applied hardware. Drilling and tapping for surface-applied hardware may be done at the Project site.
3. Locate door hardware as indicated on final shop drawings or, if not indicated, in accordance with DHI RLAHSSDF.

2.10 FINISH MATERIALS

A. General: Comply with NAAMM MFM for recommendations relative to applying and designating finishes. Comply with SSPC PA-1, for steel sheet finishes. Apply primers and organic finishes to doors and frames after fabrication.

B. Shop Painting: Clean, treat, and paint exposed surfaces of steel doors and frames, including, but not limited to, galvanized surfaces, but excluding stainless steel surfaces.

1. Clean steel surfaces of mill scale, rust, oil, grease, dirt, and other foreign materials before applying paint.
2. Apply pretreatment to cleaned metal surfaces; use cold phosphate solution (SSPC PT-2), hot phosphate solution (SSPC PT-4), or basic zinc chromate vinyl butyral wash primer (SSPC Paint 27).
3. Apply shop coat of prime paint within time limits recommended by pretreatment manufacturer. Apply a smooth coat of even consistency to provide a uniform dry film thickness of not less than 0.7 mils.

C. Galvanized Steel Sheet Finishes:

1. Surface Preparation: Clean surfaces with non-petroleum solvent so that surfaces are free of oil or other contaminants. After cleaning, apply a conversion coating of the type suited to the organic coating applied over it. Clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A 780.
    a. Galvanizing Repair Paint: Provide high zinc dust content paint for regalvanizing welds in galvanized steel, with dry film containing not less than 94 percent zinc dust by weight, and complying with SSPC Paint 20.
2. Factory Priming for Field-Painted Finish: Where field painting after installation is indicated, apply air-dried primer specified below immediately after cleaning and pretreatment. Field-applied paint finish is specified in Section 09900 - PAINTING.
    a. Shop Primer: Zinc dust, zinc oxide primer paint complying with performance requirements of FS TT-P-641, Type II.

D. Steel Sheet Finishes:

1. Surface Preparation: Solvent clean surfaces to comply with SSPC SP-1 to remove dirt, oil, grease, and other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel to comply with SSPC SP-5 (white metal blast cleaning) or SSPC SP-8 (pickling).
2. Pretreatment: Immediately after surface preparation, apply a conversion coating of type suited to organic coating applied over it.
3. Factory Priming for Field-Painted Finish: Apply shop primer that complies with ANSI A250.10 acceptance criteria, is compatible with finish paint systems indicated, and has capability to provide a sound foundation for field-applied topcoats. Apply primer immediately after surface preparation and pretreatment. Field-applied paint finish is specified in Section 09900 - PAINTING.

E. Bituminous Coating: Asphalt emulsion or other high-build, water-resistant, resilient coating.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

3.2 PREPARATION

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

3.3 INSTALLATION

A. Install in accordance with the requirements of the specified door grade standard and NAAMM HMMA 840.

B. In addition, install fire rated units in accordance with NFPA 80.

C. Placing Frames: Comply with provisions of ANSI A250.11, unless otherwise indicated. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders, leaving surfaces smooth and undamaged. Field splice only at approved locations. Weld, grind, and finish as required to conceal evidence of splicing on exposed faces.

1. Except for frames located in existing concrete, masonry, or gypsum board assembly construction, place frames before constructing enclosing walls and ceilings.
2. In masonry construction, install at least three wall anchors per jamb adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Acceptable anchors include, but shall not be limited to, masonry wire anchors and masonry T- shaped anchors.
3. Floor anchors may be set with powder-actuated fasteners instead of masonry anchorage devices and machine screws, if so indicated on shop drawings.
4. At existing concrete or masonry construction, install at least three completed opening anchors per jamb adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Set frames and secure to adjacent construction with machine screws, bolts, and masonry anchorage devices.
    a. Set anchorage devices opposite each anchor location, according to details on shop drawings and anchorage device manufacturer's instructions. Leave drilled holes rough, not reamed, and free from dust and debris.
5. In wood stud partitions, install at least three wall anchors per jamb at hinge and strike levels. In wood stud partitions, attach wall anchors to studs with screws.
6. Install fire-rated frames according to NFPA 80.

D. Door Installation: Fit hollow metal doors accurately in frames, within clearances specified in ANSI A250.8.

1. Fit non-fire-rated doors accurately in their respective frames, with the following clearances:
    a. Jambs and Head: 3/32 inch.
    b. Meeting Edges, Pairs of Doors: 1/8 inch.
    c. Bottom: 3/8 inch if no threshold or carpet; 1/8 inch with threshold or carpet.
    d. Place fire-rated doors with clearances as specified in NFPA 80.

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.

3.4 TOLERANCES

A. Clearances Between Door and Frame: As specified in ANSI A250.8.

B. Maximum Diagonal Distortion: 1/16 in measured with straight edge, corner to corner.

3.5 ADJUSTING

A. Adjust for smooth and balanced door movement.

B. Adjust sound control doors so that seals are fully engaged when door is closed.

C. Test sound control doors for force to close, latch, and unlatch in accordance with ASTM E 1408; adjust as required to comply.

END OF SECTION 08110

SECTION 08211 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Flush wood doors; flush configuration; fire rated, non-rated, and acoustical.

B. Factory fitting flush wood doors to frames and factory machining for hardware.

1.2 RELATED REQUIREMENTS

A. Section 06200 - Finish Carpentry.

B. Section 08110 - Steel Doors and Frames.

C. Section 08710 - Door Hardware.

D. Section 08800 - Glazing.

1.3 REFERENCE STANDARDS

A. ASTM E 413 - Classification for Rating Sound Insulation; 2004.

B. ASTM E 1408 - Standard Test Method for Laboratory Measurement of the Sound Transmission Loss of Door Panels and Door Systems; 1991 (Reapproved 2000).

C. AWI (QCP) – Quality Certification Program, www.awiqcp.org; current edition at www.awiqcp.org.

D. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2009.

E. UBC Std 7-2, Part II - Test Standard for Smoke- and Draft-control Assemblies; International Conference of Building Officials; 1997.

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.1-A - Architectural Wood Flush Doors; Window and Door Manufacturers Association; 2004.

1.4 SUBMITTALS

A. See Section 01300 - 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.

1. Provide the information required by AWI/AWMAC/WI Architectural Woodwork Standards.

D. Specimen warranty.

E. Test Reports: Show compliance with specified requirements for the following:

F. Samples for Initial Selection: Color charts consisting of actual materials in small sections for the following:

1. Faces of Factory-Finished Doors: Show the full range of colors available for stained finishes.

G. Samples: Submit two samples of selected door veneer, 12 x 12 inch in size illustrating wood grain, stain color, and sheen.

H. Warranty, executed in Owner's name.

1.5 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 three years of documented experience.

C. Source Limitations: Obtain flush wood doors through one source from a single manufacturer.

D. Quality Standard: Comply with AWI's "Architectural Woodwork Quality Standards Illustrated."

1. Provide AWI Quality Certification Labels or an AWI letter of licensing for Project indicating that doors comply with requirements of grades specified.

E. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.

1. Test Pressure: Test at atmospheric pressure.
2. Temperature-Rise Rating: At exit enclosures, provide doors that have a temperature- rise rating of 450 deg F (250 deg C) maximum in 30 minutes of fire exposure.

1.6 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.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until building is enclosed, wet work is complete, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.

1.8 WARRANTY

A. See Section 01780 - 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

2.1 MANUFACTURERS

A. Wood Veneer Faced Doors:
1. Graham Wood Doors: www.grahamdoors.com.
2. Eggers Industries: www.eggersindustries.com.
3. Marshfield Door Systems, Inc: www.marshfielddoors.com.
4. Oshkosh Door Company (Added by Addendum No. 2).
5. Substitutions: See Section 01600 - Product Requirements.

2.2 DOORS AND PANELS

A. All Doors: See drawings for locations and additional requirements.
1. Quality Level: Premium Grade, in accordance with AWI/AWMAC/WI Architectural Woodwork Standards.

B. Doors for Transparent Finish (Stain and/or Natural):
1. Grade: Premium, with Grade AA faces.
2. Species and Cut: Cherry.

2.3 LIGHT FRAMES

A. Wood Beads for Light Openings in Wood Doors:
1. Select one of three species below.
2. Wood Species: Same species as door faces.
3. Profile: Flush rectangular beads.
4. Wood-Veneered Beads for Light Openings in Fire Doors: Manufacturer's standard wood-veneered noncombustible beads matching veneer species of door faces and approved for use in doors of fire rating indicated. Include concealed metal glazing clips where required for opening size and fire rating indicated.

2.4 DOOR AND PANEL CORES

A. Non-Rated Solid Core and 20 Minute Rated Doors: Type particleboard core (PC), plies and faces as indicated above.
1. Particleboard: ANSI A208.1, Grade LD-2.
a. Blocking: Provide wood blocking in particleboard-core doors as follows:
1) 5-inch (125-mm) top-rail blocking, in doors indicated to have closers.
2) 5-inch (125-mm) midrail blocking, in doors indicated to have exit devices.

B. Fire Rated Doors: Mineral core, Type FD, plies and faces as indicated above; with core blocking as required to provide adequate anchorage of hardware without through-bolting.
1. Blocking: For mineral-core doors, provide composite blocking with improved screw-holding capability approved for use in doors of fire ratings indicated and as follows:
a. 5-inch (125-mm) top-rail blocking.
b. 5-inch (125-mm) bottom-rail blocking, in doors indicated to have protection plates.
c. 5-by-18-inch (114-by-250-mm) lock blocks (125-mm).
2. Edge Construction: At hinge stiles, provide manufacturer's standard laminated-edge construction with improved screw-holding capability and split resistance and with outer stile matching face veneer.

C. Sound Retardant Doors: Equivalent to Type PC construction with core as required to achieve rating specified; plies and faces as indicated above.

2.5 DOOR FACINGS

A. Wood Veneer Facing for Transparent Finish: Species as specified above, veneer grade as specified by quality standard, rotary cut, book veneer match, center balance assembly match; unless otherwise indicated.
1. Vertical Edges: Any option allowed by quality standard for grade.
2. Pairs: Pair match each pair; set match pairs within 10 feet of each other when doors are closed.

B. Construction: Five or seven plies with stiles and rails bonded to core, then entire unit abrasive planed before veneering.

2.6 ACCESSORIES

A. Wood Louvers:
1. Material and Finish: Cherry species.

B. Glazing Stops: Wood, of same species as door facing, butted corners; prepared for countersink style tamper proof screws.

C. Astragals for Non-Rated Double Doors: Steel, T shaped, overlapping and recessed at face edge.

D. Astragals for Fire Rated Double Doors: Steel, T shaped, overlapping and recessed at face edge, specifically for double doors.

2.7 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.

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.

2.8 FACTORY FINISHING - WOOD VENEER DOORS

A. Finish work in accordance with AWI/AWMAC/WI Architectural Woodwork Standards, Section 5 - Finishing for Grade specified and as follows:
   1. Transparent:
      a. System - 5, Varnish, Conversion.
      b. Stain: As selected by Architect.
      c. Sheen: Satin.

B. Factory finish doors in accordance with approved sample.

C. Seal door top edge with color sealer to match door facing.

PART 3 - EXECUTION

3.1 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.

3.2 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. Hardware: For installation, see Division 8 Section "Door Hardware."

C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal cut surfaces after fitting and machining.

1. Clearances: Provide 1/8 inch at heads, jambs, and between pairs of doors. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering. Where threshold is shown or scheduled, provide 1/4 inch from bottom of door to top of threshold.
   a. Comply with NFPA 80 for fire-rated doors.
2. Bevel non-fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) at lock and hinge edges.
3. Bevel fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) at lock edge; trim stiles and rails only to extent permitted by labeling agency.

D. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.

E. Use machine tools to cut or drill for hardware.

F. Coordinate installation of doors with installation of frames and hardware.

G. Coordinate installation of glazing.

3.3 ADJUSTING

A. Adjust doors for smooth and balanced door movement.

B. Finished Doors: Replace doors that are damaged or do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

C. Adjust closers for full closure.

END OF SECTION 08211

SECTION 08331 - OVERHEAD COILING DOORS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Overhead coiling doors, operating hardware, exterior, manual operation.

1.2 RELATED REQUIREMENTS

A. Section 05500 - Metal Fabrications: Support framing.

B. Section 09900 - Paints and Coatings: Field paint finish.

1.3 REFERENCE STANDARDS

A. ASTM A 123/A 123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2002.

B. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2007.

1.4 SUBMITTALS

A. Product Data: Provide general construction, component connections and details.

B. Shop Drawings: Indicate pertinent dimensioning, anchorage methods, hardware locations, and installation details.

C. Manufacturer's Instructions: Indicate installation sequence and procedures, adjustment and alignment procedures.

D. Maintenance Data: Indicate lubrication requirements and frequency and periodic adjustments required.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Overhead Coiling Doors:
   1. Alpine Overhead Doors, Inc: www.alpinedoors.com.
   2. Cornell Iron Works, Inc: www.cornelliron.com.
   3. The Cookson Company: www.cooksondoor.com.
   4. Wayne-Dalton Corporation: www.waynedalton.com.
   5. Overhead Door and Fireplace Co., Inc.

2.2 COILING DOORS

A. Exterior Coiling Doors: Steel slat curtain.
1. Capable of withstanding positive and negative wind loads of 20 psf, without undue deflection or damage to components.
2. Single thickness slats.
3. Nominal Slat Size: 2 inches wide x required length.
4. Finish: Factory powder-coated paint, Refer to Drawings for color selection.
5. Guides: Angles; galvanized steel.
6. Hood Enclosure: Manufacturer's standard; primed steel.
7. Manual hand chain lift operation.
8. Mounting: As indicated.

2.3 MATERIALS

A. Curtain Construction: Interlocking slats.
1. Slat Ends: Alternate slats fitted with end locks to act as wearing surface in guides and to prevent lateral movement.
2. Curtain Bottom: Fitted with angles to provide reinforcement and positive contact in closed position.
3. Weatherstripping: Moisture and rot proof, resilient type, located at jamb edges, bottom of curtain, and where curtain enters hood enclosure of exterior doors.

B. Steel Slats: Minimum 20 gage ASTM A 653/A 653M galvanized steel sheet.

C. Guide Construction: Continuous, of profile to retain door in place, mounting brackets of same metal.

D. Steel Guides: Formed from galvanized steel sheet, 16 gage; 2-3 inch wide; complying with ASTM A 653/A 653M. Steel guide finish to have factory applied powder coated paint, in lieu of galvanizing.
1. Galvanizing: Minimum G90/Z275 coating.

E. Hood Enclosure: Internally reinforced to maintain rigidity and shape.
1. Minimum 20 gage.
2. Prime paint. Hood finish to have factory applied powder coated paint.

F. Hardware:
1. Provide sliding lock bar designed for padlock. Padlock not included.

G. Roller Shaft Counterbalance: Steel pipe and helical steel spring system, capable of producing torque sufficient to ensure smooth operation of curtain from any position and capable of holding position at mid-travel; with adjustable spring tension; requiring 25 lb nominal force to operate.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that opening sizes, tolerances and conditions are acceptable.

3.2 INSTALLATION

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

B. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.

C. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.

D. Fit and align assembly including hardware; level and plumb, to provide smooth operation.

E. Coordinate installation of sealants and backing materials at frame perimeter as specified in Section 07900.

F. Install perimeter trim and closures.

3.3 TOLERANCES

A. Maintain dimensional tolerances and alignment with adjacent work.

B. Maximum Variation From Plumb: 1/16 inch.

C. Maximum Variation From Level: 1/16 inch.

D. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch per 10 ft straight edge.

3.4 ADJUSTING

A. Adjust operating assemblies for smooth and noiseless operation.

3.5 CLEANING

A. Clean installed components.

B. Remove labels and visible markings.

END OF SECTION 08331

SECTION 08410 - METAL-FRAMED STOREFRONTS

PART 1 - GENERAL SUMMARY

1.1 Related Documents: Conditions of the Contract, Division 1 - General Requirements, and Drawings apply to Work of this Section.

1.2 SECTION INCLUDES

A. Aluminum-framed storefront.

B. Aluminum doors and frames.

C. Weatherstripping and thresholds.

1.3 RELATED REQUIREMENTS

A. Section 05120 - Structural Steel: Steel attachment members.

B. Section 07900 - Joint Sealers: Perimeter sealant and back-up materials.

C. Section 08710 - Door Hardware: Hardware items other than specified in this section.

D. Section 08800 - Glazing: Glass and glazing accessories.

E. Section 08910 - Metal-Framed Curtain Wall: Framing for entrance doors.

1.4 1.4 REFERENCE STANDARDS

A. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site; American Architectural Manufacturers Association; 2004.

B. AAMA 501.2 - Field Check of Metal Storefronts, Curtain Walls, and Sloped Glazing Systems for Water Leakage; American Architectural Manufacturers Association; 2003 (part of AAMA 501).

C. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; American Architectural Manufacturers Association; 1998.

D. ASCE 7 - Minimum Design Loads for Buildings and Other Structures; American Society of Civil Engineers; 2005.

E. ASTM B 209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2007.

F. ASTM B 209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric]; 2007.

G. ASTM B 221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2006.

H. ASTM B 221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric]; 2007.

I. ASTM E 283 - 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.

J. ASTM E 330 - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2002.

K. ASTM E 331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000.

1.5 PERFORMANCE REQUIREMENTS

A. Design and size components to withstand the following load requirements without damage or permanent set, when tested in accordance with ASTM E 330, using loads 1.5 times the design wind loads and 10 second duration of maximum load.

B. Design Wind Loads: Comply with requirements of 2006 IBC code.

C. Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.

D. Movement: Accommodate movement between storefront and perimeter framing and deflection of lintel, without damage to components or deterioration of seals.

E. Air Infiltration: Limit air infiltration through assembly to 0.06 cu ft/min/sq ft of wall area, measured at a reference differential pressure across assembly of 1.57 psf as measured in accordance with ASTM E 283.

F. Water Leakage: None, when measured in accordance with ASTM E 331 with a test pressure difference of 2.86 lbf/sq ft.

G. 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.

H. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.

1.6 SUBMITTALS

A. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, door hardware, internal drainage details.

B. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related Work, expansion and contraction joint location and details, and field welding required.

C. Design Data: Provide framing member structural and physical characteristics, engineering calculations, dimensional limitations.

D. Hardware Schedule: Complete itemization of each item of hardware to be provided for each door, cross-referenced to door identification numbers in Contract Documents.

E. Manufacturer's Certificate: Certify that the products supplied meet or exceed the specified requirements.

1.7 1.7 QUALITY ASSURANCE

A. Manufacturer and Installer Qualifications: Company specializing in manufacturing aluminum glazing systems with minimum three years of documented experience.

1.8 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.

1.9 FIELD CONDITIONS

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

1.10 WARRANTY

A. Correct defective Work within a five year period after Date of Substantial Completion.

B. 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

2.1 MANUFACTURERS

A. A. Acceptable Manufacturers:

B. Kawneer North America: www.kawneer.com.

C. United States Aluminum Corp: www.usalum.com.

D. Vistawall Architectural Products: www.vistawall.com.

2.2 COMPONENTS

A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.

B. Finish: High performance organic coating.

C. Basis of Design: Kawneer 451T with front set glazing.
1. Aluminum Framing Members: Tubular aluminum sections, drainage holes and internal weep drainage system.
2. Glazing stops: Flush.
3. Cross-Section: 2" x 4-1/2" inch nominal dimension. Some sills and vertical elements will be 4-1/2" x 4-1/2" nominal dimension.
4. Structurally Reinforced Members: Extruded aluminum with internal reinforcement of structural steel member.
5. C. Doors: Glazed aluminum.
6. Thickness: 1-3/4 inches.
7. Top Rail: 5 inches wide.
8. Vertical Stiles: 5 inches wide.
9. Bottom Rail: 10 inches wide.
10. Glazing Stops: Square.
11. Finish: Same as storefront.

D. Basis of Design: Kawneer 451 wide stile.

2.3 MATERIALS

A. A. Extruded Aluminum: ASTM B 221 (ASTM B 221M).

B. B. Sheet Aluminum: ASTM B 209 (ASTM B209M).

C. C. Fasteners: Stainless steel.

D. D. Glass: As specified in Section 08800.

E. Glass in Exterior Doors: 1/4", gray tinted to match storefront glazing.

F. Glass in Interior Doors and Storefront: 1/4", clear.

G. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.

H. Glazing Accessories: As specified in Section 08800.

2.4 FINISHES

A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils thick.

B. Touch-Up Materials: As recommended by coating manufacturer for field application.

2.5 HARDWARE

A. Door Hardware: Refer to Section 08710 for other requirements.

B. Door Hardware: Storefront manufacturer's standard type to suit application.
1. Finish on Hand-Contacted Items: Polished chrome.

C. Weatherstripping: Wool pile, continuous and replaceable; provide on all exterior 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; provide on all doors.

F. Hinges:;.
   1. Continuous Geared Hinges:
      a. Hager Companies (HAG).
      b. Markar Products, Inc. (MP).
      c. McKinney Products Company; Div. of ESSEX Industries, Inc. (MCK).
      d. Pemko Manufacturing Co., Inc. (PEM).
      e. Select Products Limited (SPL).
      f. Zero International, Inc. (ZRO).
   2. Provide on all doors.

G. Exit Devices: Refer to 08710 - Finish Hardware. Provide vertical rod type at pairs of double doors.

H. Closers: Refer to 08710 - Finish Hardware.

I. Handle Latch: Refer to 08710 - Finish Hardware.

J. Locks: Refer to 08710 - Finish Hardware.

2.6 FABRICATION

A. Fabricate components with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.

B. Accurately fit and secure joints and corners. Make joints flush, hairline, and weatherproof.

C. Prepare components to receive anchor devices. Fabricate anchors.

D. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.

E. Arrange fasteners and attachments to conceal from view.

F. Reinforce components internally for door hardware.

G. Reinforce framing members for imposed loads.

H. Finishing: Apply factory finish to all surfaces that will be exposed in completed assemblies.
   1. Touch-up surfaces cut during fabrication so that no natural aluminum is visible in completed assemblies, including joint edges.

PART 3 - EXECUTION

3.1 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.

3.2 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. Coordinate attachment and seal of perimeter air and vapor barrier materials.

H. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

I. Install glass in accordance with Section 08800, using glazing method required to achieve performance criteria.

J. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.3 TOLERANCES

A. Maximum Variation from Plumb: 0.06 inches every 3 ft non-cumulative or 1/16 inches per 10 ft, whichever is less.

B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

3.4 FIELD QUALITY CONTROL

A. See Section 01400 - Quality Requirements, for independent testing and inspection requirements. Inspection will monitor quality of installation and glazing.

B. Test installed storefront for water leakage in accordance with AAMA 501.2. Use 12 psf for field testing of both storefronts and curtainwall.

3.5 ADJUSTING

A. Adjust operating hardware and sash for smooth operation.

3.6 CLEANING

A. Remove protective material from pre-finished aluminum surfaces.

B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.

C. Remove excess sealant by method acceptable to sealant manufacturer.

3.7 PROTECTION

A. Protect installed products from damage during subsequent construction.

B. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

C. Protect finished work from damage.

END OF SECTION 08410

SECTION 08710 - DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes items known commercially as finish or door hardware that are required for swing, sliding, and folding doors, except special types of unique hardware specified in the same sections as the doors and door frames on which they are installed.

B. This Section includes the following:
1. Hinges
2. Continuous hinges
3. Key control system
4. Lock cylinders and keys
5. Lock and latch sets
6. Bolts
7. Exit devices
8. Push/Pull units
9. Closers
10. Overhead holders
11. Miscellaneous door control devices
12. Door trim units
13. Protection plates
14. Weather stripping for exterior doors
15. Sound stripping for interior doors
16. Automatic drop seals (door bottoms)
17. Astragals or meeting seals on pairs of doors
18. Thresholds

C. Related Sections: The following Sections contain requirements that relate to this Section:
1. Section 08 110: Hollow Metal Doors and Frames
2. Section 08 140: Wood Doors
3. Section 08 333: Coiling Doors
4. Section 08 410: Aluminum-Framed Entrances and Storefronts
5. Division 26: Electrical

D. Products furnished but not installed under this Section to include:
1. Final permanent cores and keys to be installed by Owner.

1.3 REFERENCES

A. Standards of the following as referenced:
1. American National Standards Institute (ANSI)
2. Door and Hardware Institute (DHI)
3. Factory Mutual (FM)
4. National Fire Protection Association (NFPA)
5. Underwriters' Laboratories, Inc. (UL)
   a. UL 10C - Fire Tests Door Assemblies
6. Warnock Hersey

B. Regulatory standards of the following as referenced:
1. Department of Justice, Office of the Attorney General, *Americans with Disabilities Act*, Public Law 101-336 (ADA).
2. CABO/ANSI A117.1: *Providing Accessibility and Usability for Physically Handicapped People*, 1992 edition.

1.4 SYSTEM DESCRIPTION

A. Refer to applicable “Headings” for system description for electric and electro-pneumatic hardware products.

1.5 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification sections.

B. Product data including manufacturers' technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements. For items other than those scheduled in the “Headings” of Section 3, provide catalog information for the specified items and for those submitted.

C. Final hardware schedule coordinated with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
1. Final Hardware Schedule Content: Based on hardware indicated, organize schedule into vertical format “hardware sets" indicating complete designations of every item required for each door or opening. Use specification Heading numbers with any variations suffixed a, b, etc. Include the following information:
   a. Type, style, function, size, and finish of each hardware item.
   b. Name and manufacturer of each item.
   c. Fastenings and other pertinent information.
   d. Location of each hardware set cross-referenced to indications on Drawings both on floor plans and in door and frame schedule.
   e. Explanation of all abbreviations, symbols, and codes contained in schedule.
   f. Mounting locations for hardware.
   g. Door and frame sizes and materials.
   h. Keying information.
   i. Cross-reference numbers used within schedule deviating from those specified.
      1) Column 1: State specified item and manufacturer.
      2) Column 2: State prior approved substituted item and its manufacturer.

2. Furnish complete wiring diagrams, riser diagrams, elevation drawings and operational descriptions of electrical components and systems, listed by opening in the hardware submittals. Elevation drawings shall identify locations of the system components with respect to their placement in the door opening. Operational descriptions shall fully detail how each electrical component will function within the opening, including all conditions of ingress and egress. Provide a copy with each hardware schedule submitted for approval. Supply a copy with delivery of hardware to the jobsite and another copy to the Owner at the time of project completion.
3. Submittal Sequence: Submit final schedule at earliest possible date particularly where acceptance of hardware schedule must precede fabrication of other work that is critical in the Project construction schedule. Include with schedule the product data, samples, shop drawings of other work affected by door hardware, and other information essential to the coordinated review of schedule.
4. Keying Schedule: Submit separate detailed schedule indicating clearly how the Owner's final instructions on keying of locks has been fulfilled.

D. Provide samples if requested of each type of exposed hardware unit in finish indicated and tagged with full description for coordination with schedule. Submit samples prior to submission of final hardware schedule.
1. Samples will be returned to the supplier. Units that are acceptable and remain undamaged through submittal, review, and field comparison process may, after final check of operation, be incorporated in the Work, within limitations of keying coordination requirements.

E. Templates for doors, frames, and other work specified to be factory prepared for the installation of door hardware. Check shop drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

F. Contract closeout submittals:
1. Operation and maintenance data: Complete information for installed door hardware.
2. Warranty: Completed and executed warranty forms.

1.6 QUALITY ASSURANCE

A. Single Source Responsibility: Obtain each type of hardware (latch and locksets, hinges, closers, etc.) from a single manufacturer.

B. Supplier Qualifications: A recognized architectural door hardware supplier, with warehousing facilities in the Project's vicinity, that has a record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this Project and that employs an experienced Architectural Hardware Consultant (AHC) who is available for consultation to Owner, Architect, and Contractor, at reasonable times during the course of the Work.

C. Coordination Meetings:
1. Contractor to set up and attend the following:
a. Lock distributor to meet with the Owner to finalize lock functions and keying requirements and to obtain final instructions in writing.
b. Lock distributor and lock, closer and exit device manufacturer to meet with the installer prior to beginning of installation of door hardware. Instruct installer on proper installation of specified products.
2. General Contractor to set up and attend the following:
a. Meet with the Owner, General Contractor, Supplier, electrical and security contractors to coordinate all electrical hardware items. Supplier to provide riser diagrams, elevation drawings, wiring diagrams and operational descriptions as required by the General and sub-contractors.

D. Fire-Rated Openings: Provide door hardware for fire-rated openings that complies with NFPA Standard No. 80 requirements of authorities having jurisdiction. Provide only items of door hardware that are listed and tested by UL or Warnock Hersey for given type/size opening and degree of label. Provide proper latching hardware, door closers, approved-bearing hinges and seals whether listed in the Hardware Schedule or not. All hardware to comply with State and local codes and UL 10C.
1. Where emergency exit devices are required on fire-rated doors, (with supplementary marking on doors' UL labels indicating "Fire Door to be equipped with Fire Exit Hardware") provide UL label on exit devices indicating "Fire Exit Hardware".

E. All hardware is to comply with Federal and State Handicap laws. Provide tactile warning at the back of all outside levers to electrical, mechanical, machine rooms and doors that lead to hazardous areas.

1.7 PRODUCT HANDLING

A. Tag each item or package separately with identification related to final hardware schedule, and include basic installation instructions with each item or package.

B. Packaging of door hardware is responsibility of supplier. As material is received by hardware supplier from various manufacturers, sort and repackage in containers clearly marked with appropriate hardware set number to match set numbers of approved hardware schedule. Two or more identical sets may be packed in same container.

C. Inventory door hardware jointly with representatives of hardware supplier and hardware installer until each is satisfied that count is correct.

D. Deliver individually packaged door hardware items promptly to place of installation (shop or Project site).

E. Provide secure lock-up for door hardware delivered to the Project, but not yet installed. Control handling and installation of hardware items that are not immediately replaceable so that completion of the Work will not be delayed by hardware losses both before and after installation.

1.8 WARRANTY

A. Special warranties:
1. Door Closers: Ten year period
2. Exit Devices: Three year period
3. Automatic Door Operators: Two year period
4. Locks and Cylinders: Three year period

1.9 MAINTENANCE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions that are packed in hardware items for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS (*Denotes manufacturer referenced in the Hardware Headings)

A. Hinges:
1. Acceptable manufacturers:
a. Ives*
b. Bommer
c. Hager
d. Stanley
2. Characteristics:
a. Templates: Provide only template-produced units.
b. Screws: Provide Phillips flat-head screws complying with the following requirements:
1) For metal doors and frames install machine screws into drilled and tapped holes.
2) For wood doors and frames install threaded-to-the-head wood screws.
3) For fire-rated wood doors install #12 x 1-1/4 inch, threaded-to-the-head steel wood screws.
4) Finish screw heads to match surface of hinges or pivots.
c. Hinge pins: Except as otherwise indicated, provide hinge pins as follows:
1) Out-Swing Exterior Doors: Non-removable pins.
2) Out-Swing Corridor Doors with Locks: Non-removable pins.
3) Interior Doors: Non-rising pins.
4) Tips: Flat button and matching plug. Finished to match leafs.
d. Size: Size hinges in accordance with specified manufacturer’s published recommendations.
e. Quantity: Furnish one pair of hinges for all doors up to 5’-0" high. Furnish one hinge for each additional 2-1/2 feet or fraction thereof.

B. Continuous Hinges:
   1. Acceptable manufacturers:
      a. Ives*
      b. Select Products
      c. Markar
   2. Characteristics:
      a. Continuous gear hinges to be manufactured of extruded 6063-T6 aluminum alloy with anodized finish, or factory painted finish as scheduled.
      b. All hinges are to be manufactured to template. Uncut hinges to be non-handed and to be a pinless assembly of three interlocking extrusions applied to the full height of the door and frame without mortising.
      c. Vertical door loads to be carried on chemically lubricated polyacetal thrust bearings. The door and frame leaves to be continually geared together for the entire hinge length and secured with a full cover channel. Hinge to operate to a full 180^{o}.
      d. Hinges to be milled, anodized and assembled in matching pairs. Fasteners supplied to be steel self drilling, self tapping 12-24 x ¾" screws.
      e. Provide UL listed continuous hinges at fire doors. Continuous hinges at fire doors (suffix -FR) to meet the required ratings without the use of auxiliary fused pins or studs.

C. Permanent Key Cylinder Cores:
   1. Acceptable manufacturers:
      a. Best Locking Systems (to coordinate with campus standard)
   2. Characteristics:
      a. Existing System: Grandmaster key the locks to the Owner's Best existing system, with a new master key for the Project.
      b. Review the keying system with the Owner and provide the type required (master, grandmaster or great-grandmaster), either new or integrated into Owner's existing system.
      c. Equip locksets with small format interchangeable core (SFIC) cylinders compatible with Owner's existing Best key system.
         1) Owner to furnish existing key bitting records to Supplier/Manufacturer for integration of new cylinders into existing key system.
      d. Furnish final cores and keys for installation by Owner.
      e. Metals: Construct lock cylinder parts from brass or bronze, stainless steel, or nickel silver.
      f. Comply with Owner's instructions for master keying and, except as otherwise indicated, provide individual change key for each lock that is not designated to be keyed alike with a group of related locks.
         1) Permanently inscribe each key with number of lock that identifies cylinder manufacturer's key symbol, and notation, "DO NOT DUPLICATE."
      g. Key Material: Provide keys of nickel silver only.
      h. Key Quantity: Furnish 3 change keys for each lock, 5 master keys for each master system, 5 grandmaster keys for each grandmaster system, 5 construction master keys and 5 control keys for interchangeable core series.
         1) Furnish one extra blank for each lock.
         2) Furnish construction master keys to General Contractor.
         3) Deliver keys to Owner.

D. Locksets, Latchsets, Deadbolts:
   1. Acceptable manufacturers:
      a. Best Locking Systems*, 45H Series
      b. Schlage, L9000 Series
      c. Corbin Russwin Series ML 2200
   2. Mortise Locksets and Latchsets: as scheduled.
      a. Chassis: Cold-rolled steel, handing field-changeable without disassembly.
      b. Latchbolts: 3/4-inch throw stainless steel anti-friction type.
      c. Lever Trim: Through-bolted, accessible design, cast or solid rod lever as scheduled. Spindles: Independent break-away.
      d. Thumbturns: Accessible design not requiring pinching or twisting motions to operate.
      e. Deadbolts: Stainless steel 1-inch throw.
      f. Electric operation: Manufacturer-installed continuous duty solenoid.
      g. Strikes: 16 gage curved stainless steel, bronze or brass with 1" deep box construction, lips of sufficient length to clear trim and protect clothing.
      h. Scheduled Lock Series and Design: Best 45H Series, 14R Lever.
      i. Certifications:
         1) ANSI A156.13, 1994, Grade 1 Operational, Grade 1 Security.
         2) ANSI/ASTM F476-84 Grade 30 UL Listed.
   3. Deadbolts: as scheduled. Rotating cylinder trim rings of attack-resistant design. Mounting plates and actuator shields of plated cold-rolled steel. Mounting screws of 1/4" dia. steel and protected by drill-resistant ball bearings. Steel alloy deadbolt with hardened steel roller. Strike with 1/8" thick strike reinforcer and two 3" long screws. ANSI A156.5, 1992 Grade 1 certified.

E. Exit Devices:
   1. Acceptable manufacturers:
      a. Von Duprin* (to coordinate with campus standard)
      b. Precision, a division of Stanley Hardware, Apex Series 2000
      c. Detex Corporation, Advantex Series
   2. Characteristics:
      a. Exit devices to be "UL" listed for life safety. All exit devices for fire rated openings to have “UL" labels for “Fire Exit Hardware."
      b. All exit devices mounted on labeled wood doors to be mounted on the door per the door manufacturer’s requirements.
      c. All trim to be thru-bolted to the lock stile case. Lever design to match locksets.
      d. All exit devices to be made of brass, bronze, stainless steel, or aluminum material, powder coated, anodized, or plated to the standard architectural finishes to match the balance of the door hardware.
      e. Provide glass bead conversion kits to shim exit devices on doors with raised glass beads.
      f. All exit devices to be one manufacturer. No deviation will be considered.
      g. All series exit devices to incorporate a fluid damper, which decelerates the touchpad on its return stroke and eliminates noise associated with exit device operation. All exit devices to be non-handed. Touchpad to extend a minimum of 1/2 of the door width and to extend to the height of the cross rail housing for a “no pinch” operation. Plastic touchpads are not acceptable. All latchbolts to be the deadlocking type. Latchbolts to have a self-lubricating coating to reduce wear. Plated or plastic coated latchbolts are not acceptable. Plastic linkage and “dogging” components are not acceptable.

h. Lever trim to be solid case material with a break-away feature to limit damage to the unit from vandalism.

i. Surface vertical rod devices to be UL labeled for fire door applications without the use of bottom rod assemblies. Where bottom rods are required for security applications, the devices to be UL labeled for fire doors applications with rod and latch guards by the device manufacturer.

j. Exit devices to include impact resistant, flush mounted end cap design to avoid damage due to carts and other heavy objects passing through an opening. End cap to be of heavy-duty metal alloy construction and provide horizontal adjustment to provide alignment with device cover plate. When exit device end cap is installed, no raised edges will protrude.

F. Closers and Door Control Devices:

1. Acceptable manufacturers:

a. LCN Closers* (to coordinate with campus standard), 4041 Series (Exterior), 1461 Series (Interior)

b. Corbin Russwin, Series DC8210 (A3/A4/A5) (Exterior), Series DC8200 (A3/A10) (Interior)

c. Sargent, 281 Series (Exterior), 281 Series (Interior)

2. Characteristics:

a. Door closers to have fully hydraulic, full rack and pinion action with a high strength cast iron cylinder.

b. All closers to utilize a stable fluid withstanding temperature range of 120^{O}F to - 30^{O}F without seasonal adjustment of closer speed to properly close the door. Closers for fire-rated doors to be provided with temperature stabilizing fluid that complies with standards UBC 7-2 (1997) and UL 10C.

c. Spring power to be continuously adjustable over the full range of closer sizes, and allow for reduced opening force for the physically handicapped. Spring power adjustment (LCN Fast ™ Power Adjust) allows for quick and accurate power adjustment and visually shows closer power size settings by way of dial adjustment gauge located on closer spring tube. Hydraulic regulation to be by tamper-proof, non-critical valves. Closers to have separate adjustment for latch speed, general speed and back check.

d. All closers to have solid forged steel main arms (and forearms for parallel arm closers) and where specified to have a cast-in solid stop on the closer shoe ("CUSH"). All parallel arm mounted closers to have "EDA" type arms or, where door travel on out-swing doors must be limited, use "CUSH" or "SCUSH" type closers. Auxiliary stops are not required when "CUSH" type closers are used. Provide drop plates where top rail of door is not sufficient for closer mounting. Provide "cush shoe supports" and blade stop spacers where dictated by frame details.

e. All surface closers to be certified to exceed ten million (10,000,000) full load cycles by a recognized independent testing laboratory. All closers (overhead, surface and concealed) to be of one manufacturer and carry manufacturer's ten year warranty (electric closers to have two year warranty).

f. Access-Free Manual Closers: Where manual closers are indicated for doors required to be accessible to the physically handicapped provide adjustable units complying with ADA and ANSI A-117.1 provisions for door opening force.

g. Closers to be installed to allow door swing as shown on plans. Doors swinging into exit corridors to provide for corridor clear width as required by code. Where possible, mount closers inside rooms.

h. Powder coating finish to be certified to exceed 100 hours salt spray testing by ETL, an independent testing laboratory used by BHMA for ANSI certification.

G. Power Operators:

1. Acceptable manufacturers:
   a. LCN*
   b. Dor-O-Matic
   c. Horton
   d. Besam

2. Where low kinetic energy, as defined by ANSI Standard A156.19, power operators are indicated for doors required to be accessible to the disabled, provide electrically powered operators complying with the 1990 ADA for opening force and time to close standards.

3. Full closing force to be provided when the power or assist cycle ends.

4. All power operator systems to include the following features and functions.
   a. Provisions for separate conduits to carry high and low voltage wiring in compliance with the National Electrical Code, Section 725-31.
   b. When an obstruction or resistance to the opening swing is encountered, the operator will continue attempting to open the door. If the obstruction or resistance remains, the operator will again pause the door.
   c. The operator will be designed to prevent damage to the mechanism if the system is actuated while the door is latched or if the door is forced closed during the opening cycle.
   d. All covers, mounting plates and arm systems to be powder coated and successfully pass a minimum of 100 hours testing as outlined in ANSI Standard A156.18.
   e. UL listed for use on labeled doors.
   f. All operators to be non-handed with spring power over a range of at least four sizes; either 1 through 4 or 2 through 5.
   g. Provisions in the control box or module to provide control (inputs and outputs) for: electric strike delay, auxiliary contacts, sequential operation, fire alarms system, actuators, swing side sensors, stop side sensors.

5. All electrically powered operators to include the following features or functions:
   a. Easily accessible main power and maintain hold open switches will be provided on the operator.
   b. An electronically controlled clutch to provide adjustable opening force.
   c. A microprocessor to control all motor and clutch functions.
   d. An on-board power supply capable of delivering both 12V and 24V outputs up to a maximum of 1.0 ampere combined load.
   e. All input and output power wiring to be protected by slow blow fuses. These fuses to be easily replaceable without special tools or component replacement.

6. Actuators to have a stainless steel touch plate that measures 4-1/2” in diameter and features a blue filled handicap symbol. The actuator to be weather resistant and provide normally open momentary contacts. The actuator is designed to mount in a standard single gang box (2” wide, 4” high, and 2” deep).

7. Installation of the automatic door operators to be performed by a factory trained and factory certified installer skilled in the installation of automatic door operators and equipment. All low voltage switch hookups are the responsibility of the operator installer, as well as temporary wiring hookup to plug into wall outlet for test of system. Final hookup of 115VAC power will be handled by and coordinated with the General Contractor's electrical contractor.

H. Overhead Door Holders:
   1. Acceptable manufacturers:
      a. Glynn Johnson*
      b. Rixson Firemark
      c. Corbin Russwin
   2. Characteristics:
      a. Provide (heavy duty and/or medium duty and/or light duty) door holders (concealed and/or surface mounted) of brass, bronze or stainless steel.
      b. Concealed holders to be installed with the jamb bracket mortised flush with the bottom of the jamb. The arm and channel to be mortised into the door.
      c. Surface holders to be installed with the jamb bracket mounted on the stop.
      d. Types: as specified in the HW Sets.

I. Floor Stops and Wall Bumpers:
   1. Acceptable manufacturers:
      a. Trimco
      b. Ives*
      c. Rockwood Manufacturing
   2. Characteristics: Refer to Hardware Headings.

J. Door Bolts/Coordinators:
   1. Acceptable manufacturers:
      a. Trimco
      b. Ives*
      c. Rockwood Manufacturing
   2. Characteristics:
      a. Flush bolts to be forged brass 6-3/4" x 1", with 1/2" diameter bolts. Plunger to be supplied with milled surface one side that fits into a matching guide.
      b. Automatic flush bolts to be UL listed as top and bottom bolts on a pair of classified fire doors. Bolt construction to be of rugged steel and brass components.
      c. Self-latching flush bolts to be UL listed as top and bottom bolts on a pair of classified fire doors. Bolt construction to be of rugged steel and brass components.
      d. Automatic flush bolts and self-latching flush bolts to be UL listed for fire door application without bottom bolts (LBB).
      e. Furnish dust proof bottom strikes.
      f. Coordinator to be soffit mounted non-handed fully automatic UL listed coordinating device for sequential closing of paired doors with or without astragals.
      g. Provide filler piece to close the header. Provide brackets as required for mounting of soffit applied hardware.

K. Push Plates:
   1. Acceptable manufacturers:
      a. Trimco
      b. Ives*
      c. Rockwood Manufacturing

2. Characteristics:
   a. Exposed Fasteners: Provide manufacturers standard exposed fasteners.
   b. Material to be wrought/extruded/forged, brass/ bronze /aluminum/stainless steel, per the Hardware Headings.
   c. Provide plates sized as shown in Hardware Headings.

L. Door Pulls & Pull Plates:
   1. Acceptable manufacturers:
      a. Trimco
      b. Ives*
      c. Rockwood Manufacturing
   2. Characteristics:
      a. Provide concealed thru-bolted trim on back to back mounted pulls, but not for single units.
      b. Material to be extruded forged/ cast, brass/ bronze/ aluminum/ stainless steel.
      c. Provide units sized as shown in Hardware Headings.

M. Push Pull Sets:
   1. Acceptable manufacturers:
      a. Trimco
      b. Ives*
      c. Rockwood Manufacturing
   2. Characteristics:
      a. Provide mounting systems as shown in hardware sets.
      b. Material to be (description - i.e. solid rod, tubular, cast etc.). stainless steel.
      c. Provide Push/Pull sets sized as shown in Hardware Headings.

N. Protective Plates:
   1. Acceptable manufacturers:
      a. Trimco
      b. Ives*
      c. Rockwood Manufacturing
   2. Characteristics:
      a. Provide manufacturers standard exposed fasteners for door trim units consisting of either machine screws or self-tapping screws.
      b. Materials:
         1) Metal Plates: Stainless Steel, .050 inch (U.S. 18 gage).
      c. Fabricate protection plates not more than 2 inches less than door width on push side and not more than 1 inch less than door width on pull side.
      d. Heights:
         1) Kick plates to be 10 inches in height.
         2) Mop plates to be 4 inches in height.
         3) Armor plates to be 36 inches in height. Armor plates on fire doors to comply with NFPA 80.

O. Thresholds:
   1. Acceptable manufacturers:
      a. National Guard Products, Inc.*
      b. Reese Industries
      c. Zero Weatherstripping Co., Inc.
   2. Types: Indicated in Hardware Headings.

P. Door Seals/Gasketing:
1. Acceptable manufacturers:
a. National Guard Products, Inc.*
b. Reese Industries
c. Zero Weatherstripping Co., Inc.
2. Types: Indicated in Hardware Headings.

Q. Silencers:
1. Acceptable manufacturers:
a. Hager
b. Ives*
c. Rockwood Manufacturing
2. Three for each single door; two for each pair of doors.

R. Key Cabinet and System:
1. Acceptable manufacturers:
a. Telkee, Inc.
b. Key Control Systems
c. MMF Manufacturing
2. Provide a key control system including envelopes, labels, tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet, all as recommended by system manufacturer, with capacity for 150 percent of the number of locks required for the project.
a. Provide complete cross index system set up by key control distributor, and place keys on markers and hooks in the cabinet as determined by the final key schedule.
b. Provide hinged-panel type cabinet for wall mounting.
c. Type: Telkee AWC-150-S X SMTC with one P84 Core Storage Panel.

S. Security Equipment:
1. Acceptable manufacturers:
a. Von Duprin
b. Schlage Electronics
c. Best Locking Systems*
2. Characteristics:
a. Provide items as found in Hardware Headings.
3. Coordinate security equipment with electrical.

2.2 MATERIALS AND FABRICATION

A. Manufacturer's Name Plate: Do not use manufacturers' products that have manufacturer's name or trade name displayed in a visible location (omit removable nameplates) except in conjunction with required fire-rated labels and as otherwise acceptable to Architect.
1. Manufacturer's identification will be permitted on rim of lock cylinders only.

B. Base Metals: Produce hardware units of basic metal and forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness, but in no case of lesser (commercially recognized) quality than specified for applicable hardware units by applicable ANSI/BHMA A156 series standards for each type of hardware item and with ANSI/BHMA A156.18 for finish designations indicated. Do not furnish "optional" materials or forming methods for those indicated, except as otherwise specified.

C. Fasteners: Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation.

1. Do not provide hardware that has been prepared for self-tapping sheet metal screws, except as specifically indicated.
2. Furnish screws for installation with each hardware item. Provide Phillips flat-head screws except as otherwise indicated. Finish exposed (exposed under any condition) screws to match hardware finish or, if exposed in surfaces of other work, to match finish of this other work as closely as possible including “prepared for paint" surfaces to receive painted finish.
3. Provide concealed fasteners for hardware units that are exposed when door is closed except to the extent no standard units of type specified are available with concealed fasteners.
4. Where surface mounted hardware (door closers and exit devices) is to be installed, coordinate with door and frame manufacturer (wood, hollow metal, and aluminum) to insure that internal reinforcement and blocking is provided to allow attachment of hardware without the need of through bolting.

2.3 HARDWARE FINISHES

A. Match items to the manufacturer’s standard color and texture finish for the latch and lock sets (or push-pull units if no latch or lock sets).

B. Provide finishes that match those established by ANSI or, if none established, match the Architect’s sample.

C. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer’s standards, but in no case less than specified by referenced standards for the applicable units of hardware.

D. Provide protective lacquer coating on all exposed hardware finishes of brass, bronze, and aluminum, except as otherwise indicated. The suffix "-NL" is used with standard finish designations to indicate "no lacquer."

E. The designations used to indicate hardware finishes are those listed in ANSI/BHMA A156.18, "Materials and Finishes," including coordination with the traditional U.S. finishes shown by certain manufacturers for their products.

1. Hinges (Exterior): 630 (US32D) Satin Stainless Steel
2. Hinges (Interior wood doors): 652 (US26D) Satin Chrome Plated Steel
3. Continuous Hinges: 628 (US28) Clear Anodized Aluminum
4. Flush Bolts: 626 (US26D) Satin Chrome Plated Brass/Bronze
5. Locks: 630 (US32D) Satin Stainless Steel
6. Exit Devices: 628 (US28) chassis, 626 (US26D) satin chrome plated covers, and 630 (US32D) touchpads
7. Door Closers: 689 Powder Coat Aluminum
8. Push Plates: 630 (US32D) Satin Stainless Steel
9. Pull Plates: 630 (US32D) Satin Stainless Steel
10. Protective Plates: 630 (US32D) Satin Stainless Steel
11. Door Stops: 626 (US26D) Satin Chrome Plated Brass/Bronze
12. Overhead Holders: 630 Satin Stainless Steel.
13. Thresholds/Weatherstripping: 627/628 (US27/US28) Aluminum

PART 3 - EXECUTION

3.1 INSTALLATION

A. Mount hardware units at heights indicated in following applicable publications, except as specifically indicated or required to comply with governing regulations and except as otherwise directed by Architect.

1. "Recommended Locations for Builders Hardware for Standard Steel Doors and Frames" by the Door and Hardware Institute.
2. "Recommended Locations for Builders Hardware for Custom Steel Doors and Frames" by the Door and Hardware Institute.
3. NWWDA Industry Standard I.S.1.7, "Hardware Locations for Wood Flush Doors."

B. Install each hardware item in compliance with the manufacturer's instructions and recommendations. Where cutting and fitting is required to install hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation or application of surface protection with finishing work specified in the Division 9 Sections. Do not install surface-mounted items until finishes have been completed on the substrates involved.

C. Set units level, plumb, and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.

D. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

E. Set thresholds for exterior doors in full bed of butyl-rubber or polyisobutylene mastic sealant complying with requirements specified in Division 7 Section “Joint Sealers”.

F. Weatherstripping and Seals: Comply with manufacturer's instructions and recommendations to the extent installation requirements are not otherwise indicated.

3.2 ADJUSTING, CLEANING, AND DEMONSTRATING

A. Adjust and check each operating item of hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate freely and smoothly or as intended for the application made.

1. Where door hardware is installed more than one month prior to acceptance or occupancy of a space or area, return to the installation during the week prior to acceptance or occupancy and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to function properly with final operation of heating and ventilating equipment.

B. Clean adjacent surfaces soiled by hardware installation.

C. Door Hardware Supplier's Field Service:

1. Inspect door hardware items for correct installation and adjustment after complete installation of door hardware.
2. Instruct Owner's personnel in the proper adjustment and maintenance of door hardware and hardware finishes.
3. File written report of this inspection to Architect.

D. Door Hardware Manufacturer's Field Service:

1. Prior to project completion, representatives of the lock, exit device and overhead closer manufacturers to inspect and certify that all units are installed in accordance with the manufacturer's instructions, and are regulated properly and functioning correctly.

2. A written report of the inspection results and recommendations to be provided to the Architect and to include the appropriate certificates.

3.3 HARDWARE SCHEDULE

HW SET: 01
DOOR NUMBER: 042
EACH TO HAVE:

2	CONTINUOUS HINGES	224HD	IVE
2	MANUAL FLUSH BOLTS	FB458	IVE
1	DUST PROOF STRIKE	DP1	IVE
1	STOREROOM LOCK	45H7D	BES
2	DOOR POSITION SWITCHES	679-05 HM	SCE
1	SURFACE CLOSER	4041 HCUSH (ACTIVE)	LCN
1	OVERHEAD HOLDER	450H	GLY
1	THRESHOLD	425	NGP
1	SET SEALS	5050	NGP
2	DOOR SWEEPS	C627A	NGP
1	ASTRAGAL/MEETING EDGE SEAL	600A	NGP
1	DRIP CAP	16A	NGP

COORDINATE INSTALLATION WITH SECURITY AND ELECTRICAL SYSTEMS

HW SET: 02
DOOR NUMBER: 041
EACH TO HAVE:

1	CONTINUOUS HINGE	224HD	IVE
2	FLUSH BOLTS	FB458	IVE
1	EXIT DEVICE	9875L	VON
1	CYLINDER	1E7	BES
1	DOOR POSITION SWITCH	679-05 HM	SCE
1	SURFACE CLOSER	4041 CUSH	LCN
2	KICK PLATE	8400	IVE
1	THRESHOLD	425	NGP
1	SET SEALS	5050	NGP
2	DOOR SWEEP	C627A	NGP
1	DRIP CAP	16A	NGP

COORDINATE INSTALLATION WITH SECURITY AND ELECTRICAL SYSTEMS
EXIT DEVICE IN ACCORDANCE WITH NATIONAL ELECTRICAL CODES

HW SET: 03
DOOR NUMBER: C009B
EACH TO HAVE:

1	CYLINDER OR PADLOCK	1E7 OR 11B SERIES	BES
1	DOOR POSITION SWITCH	674-OH	SCE

BALANCE OF HARDWARE BY OVERHEAD DOOR SUPPLIER

HW SET: 04
DOOR NUMBER: C009C
EACH TO HAVE:

1	CONTINUOUS HINGE	224HD X EPT PREP	IVE
1	POWER TRANSFER	EPT-10	VON
1	EXIT DEVICE	RX-EL98L	VON
1	CYLINDER	1E7	BES
	CARD READER	BEST ACCESS SYSTEMS	BES
1	POWER SUPPLY	PS902	SCE
1	DOOR POSITION SWITCH	679-05 HM	SCE
1	SURFACE CLOSER	4041 CUSH	LCN
1	KICK PLATE	8400	IVE
1	THRESHOLD	425	NGP
1	SET SEALS	5050	NGP
1	DOOR SWEEP	C627A	NGP
1	DRIP CAP	16A	NGP

COORDINATE INSTALLATION WITH SECURITY AND ELECTRICAL SYSTEMS

HW SET: 05
DOOR NUMBER: V103B
EACH TO HAVE:

1	CONTINUOUS HINGE	224HD X EPT PREP	IVE
1	POWER TRANSFER	EPT-10	VON
1	EXIT DEVICE	RX98NL-OP	VON
1	CYLINDER	1E7	BES
1	DOOR POSITION SWITCH	679-05 HM	SCE
1	FLUSH PULL	94	ROC
1	SURFACE CLOSER	4041 CUSH	LCN
1	KICK PLATE	8400	IVE
1	THRESHOLD	425	NGP
1	SET SEALS	5050	NGP
1	DOOR SWEEP	C627A	NGP
1	DRIP CAP	16A	NGP

HW SET: 06
DOOR NUMBER: 001 V105 V203 V205
EACH TO HAVE:

3	HINGES	5BB1HW	IVE
1	FIRE EXIT DEVICE	98L-F	VON
1	CYLINDER	1E7	BES
1	SURFACE CLOSER	1461 REG FC	LCN
1	KICK PLATE	8400	IVE
1	FLOOR STOP	FS441	IVE
1	SET SEALS	2525	NGP
1	DOOR BOTTOM	423N	NGP

HW SET: 07
DOOR NUMBER: V102 V103A
EACH TO HAVE:

3	HINGES	5BB1HW	IVE
1	FIRE EXIT DEVICE	98L-BE-F	VON
1	SURFACE CLOSER	1461 REG FC	LCN
1	KICK PLATE	8400	IVE
1	FLOOR STOP	FS441	IVE
1	SET SEALS	2525	NGP
1	DOOR BOTTOM	423N	NGP

HW SET: 08
DOOR NUMBER: 033 034 161 181 274 297
EACH TO HAVE:

3	HINGES	5BB1HW	IVE
1	PUSH PLATE	8200 6" X 16"	IVE
1	PULL PLATE	8302 4" X 16"	IVE
1	SURFACE CLOSER	1461 DEL REG FC	LCN
1	KICK PLATE	8400	IVE
1	MOP PLATE	8400	IVE
1	WALL STOP	WS406	IVE

HW SET: 09
DOOR NUMBER: 101A 101B
EACH TO HAVE:

3	HINGES	5BB1HW	IVE
1	PASSAGE LATCH	45HN	BES
1	SURFACE CLOSER	1461 DEL REG FC	LCN
1	KICK PLATE	8400	IVE
1	MOP PLATE	8400	IVE
1	WALL STOP	WS406	IVE

HW SET: 10
DOOR NUMBER: 024D 215 218 260A
EACH TO HAVE:

3	HINGES	5BB1	IVE
1	PRIVACY LOCK	45HL W/VISUAL OCCUPANCY INDICATOR	BES
1	SURFACE CLOSER	1461 DEL FC	LCN
1	KICK PLATE	8400	IVE
1	MOP PLATE	8400	IVE
1	WALL STOP	WS406	IVE
1	SET SEALS	2525	NGP
1	DOOR BOTTOM	423N	NGP
1	COAT HOOK	582B	IVE

HW SET: 11
DOOR NUMBER: 020B 024F 103 105 106 109 113 114 126B 136A
138 140 149A 149B 164 165 168 169 171 172 175 176
204 205 208 209 212 213 221B 224 226 227 230 233
235B 236 238 260C 260D 260G 279 280 282 283 286 287
291 292
EACH TO HAVE:

3	HINGES	5PB1	IVE
1	OFFICE LOCK	45H7AT	BES
1	DOME STOP	FS436	IVE
1	COAT HOOK	582B	IVE

HW SET: 12
DOOR NUMBER: 002 004 036
EACH TO HAVE:

3	HINGES	5BB1	IVE
1	STOREROOM LOCK	45H7D	BES
1	SURFACE CLOSER	1461 CUSH (@ 002)	LCN
1	SURFACE CLOSER	1461 REG FC (@ 004)	LCN
1	FLOOR STOP	FS441 (@ 004)	IVE
1	SET SEALS	2525	NGP
1	DOOR BOTTOM	423N	NGP

HW SET: 13
DOOR NUMBER: 023 160 163 275 277
EACH TO HAVE:

3	HINGES	5PB1	IVE
1	STOREROOM LOCK	45H7D	BES
1	OVERHEAD HOLDER	450H (@ 023)	GLY
1	FLOOR STOP	FS441 (BALANCE OF DOORS)	IVE

HW SET: 14
DOOR NUMBER: 035 146 261
EACH TO HAVE:

3	HINGES	5PB1	IVE
1	STOREROOM LOCK	45H7D	BES
1	KICK PLATE	8400	IVE
1	WALL STOP	WS406	IVE

HW SET: 15
DOOR NUMBER: 201C C102 C203A C206
EACH TO HAVE:

3	HINGES	5BB1HW	IVE
1	CLASSROOM LOCK	45H7R	BES
1	SURFACE CLOSER	1461 CUSH FC	LCN
1	KICK PLATE	8400	IVE
1	SET SEALS	2525	NGP

HW SET: 16
DOOR NUMBER: C103 C207
EACH TO HAVE:

3	HINGES	5BB1HW	IVE
1	FIRE EXIT DEVICE	98L-F	VON
1	CYLINDER	1E7	BES
1	SURFACE CLOSER	1461 CUSH FC	LCN
1	KICK PLATE	8400	IVE
1	SET SEALS	2525	NGP

HW SET: 17
DOOR NUMBER: 020A 024A 024B 024C 126A 136B 144A 156A 221A 231A 231B 235A 241A 245B 248 249A 255B 260B 260J 264A 264B 268A 268B
EACH TO HAVE:

3	HINGES	5PB1	IVE
1	CLASSROOM LOCK	45H7R	BES
1	OVERHEAD HOLDER	450H (@ 024C, 221A, 231A, 231B)	GLY
1	FLOOR STOP	FS441 (BALANCE OF DOORS)	IVE

HW SET: 18
DOOR NUMBER: 016A 016B 149C 220
EACH TO HAVE:

6	HINGES	5PB1	IVE
2	MANUAL FLUSH BOLTS	FB458	IVE
1	DUST PROOF STRIKE	DP2	IVE
1	CLASSROOM LOCK	45H7R	BES
1	DUMMY TRIM SET	45HDT	BES
2	OVERHEAD HOLDERS	450H	GLY

HW SET: 19
DOOR NUMBER: 024E
EACH TO HAVE:

3	HINGES	5PB1	IVE
1	CLASSROOM LOCK	45H7R	BES
1	DOME STOP	FS436	IVE

HW SET: 20
DOOR NUMBER: 028 145B
EACH TO HAVE:

3	HINGES	5PB1	IVE
1	CLASSROOM LOCK	45H7R	BES
1	DOME STOP	FS436	IVE
1	SET SEALS	2525	NGP
1	DOOR BOTTOM	423N	NGP

HW SET: 21
DOOR NUMBER: 145A 145C
EACH TO HAVE:

3	HINGES	5PB1	IVE
1	PASSAGE LATCH	45HN	BES
1	DOME STOP	FS436	IVE
1	SET SEALS	2525	NGP
1	DOOR BOTTOM	423N	NGP

HW SET: 22
DOOR NUMBER: 016D 110B 112B 120 260F
EACH TO HAVE:

3	HINGES	5BB1	IVE
1	CLASSROOM LOCK	45H7R	BES
1	SURFACE CLOSER	1461 CUSH FC (@ 016D, 260F)	LCN
1	SURFACE CLOSER	1461 REG FC (@ 110B 112B, 120)	LCN
1	KICK PLATE	8400	IVE
1	FLOOR STOP	FS441 (@ 110B, 112B, 120)	IVE

HW SET: 23
DOOR NUMBER: 020D 144C 149E 156C 235D 241C 245D 249C 255C 264D 268D
EACH TO HAVE:

3	HINGES	5PB1	IVE
1	COMMUNICATING LOCK	45H7G	BES
1	OVERHEAD HOLDER	100H	GLY
1	SET SEALS	2525	NGP
1	DOOR BOTTOM	423N	NGP

HW SET: 24
DOOR NUMBER: C008
EACH TO HAVE:

3	HINGES	5BB1HW	IVE
1	FIRE EXIT DEVICE	98L-BE-F	VON
1	SURFACE CLOSER	1461 REG FC	LCN
1	KICK PLATE	8400	IVE
1	FLOOR STOP	FS441	IVE
1	SET SEALS	2525	NGP

HW SET: 25
DOOR NUMBER: 127A 132A
EACH TO HAVE:

3	HINGES	5BB1	IVE
1	OFFICE LOCK	45H7AT W/VISUAL OCCUPANCY INDICATOR	BES
1	SURFACE CLOSER	1461 REG FC	LCN
1	KICK PLATE	8400	IVE
1	FLOOR STOP	FS441	IVE

HW SET: 26
DOOR NUMBER: 127B 132B
EACH TO HAVE:

3	HINGES	5PB1	IVE
1	CLASSROOM LOCK	45H7R (KEY ON CHANGING SIDE)	BES
1	FLOOR STOP	FS441	IVE

HW SET: 27
DOOR NUMBER: 203A 203B
EACH TO HAVE:

3	HINGES	5BB1	IVE
1	CLASSROOM LOCK	45H7R	BES
1	SURFACE CLOSER	1461 REG FC	LCN
1	KICK PLATE	8400	IVE
1	DOME STOP	FS436	IVE
1	SET SEALS	2525	NGP
1	DOOR BOTTOM	423N	NGP

HW SET: 28
DOOR NUMBER: 216A 216B 219
EACH TO HAVE:

3	HINGES	5BB1	IVE
1	PUSH PLATE	8200 6" X 16"	IVE
1	PULL PLATE	8302 4" X 16"	IVE
1	SURFACE CLOSER	1461 HREG FC	LCN
1	KICK PLATE	8400	IVE
1	WALL STOP	WS406	IVE

HW SET: 29
DOOR NUMBER: 245A
EACH TO HAVE:

3	HINGES	5PB1	IVE
1	PASSAGE LATCH	45HN	BES
1	FLOOR STOP	FS441	IVE

HW SET: 30 – RESERVED

HW SET: 31
DOOR NUMBER: V305
EACH TO HAVE:

6	HINGES	5BB1	IVE
2	SELF-LATCHING BOLTS	FB61P	IVE
1	COORDINATOR	COR X FL	IVE
1	DUST PROOF STRIKE	DP2	IVE
1	STOREROOM LOCK	45H7D	BES
2	SURFACE CLOSERS	1461 REG FC	LCN
2	KICK PLATES	8400	IVE
2	FLOOR STOPS	FS441	IVE
1	SET SEALS	2525	NGP

2	DOOR BOTTOMS	420N	NGP
1	MEETING EDGE SEAL	5060	NGP

HW SET: 32
DOOR NUMBER: 136D
EACH TO HAVE:

6	HINGES	5BB1	IVE
2	MANUAL FLUSH BOLTS	FB458	IVE
1	DUST PROOF STRIKE	DP2	IVE
1	CLASSROOM LOCK	45H7R	BES
2	SURFACE CLOSERS	1461 HCUSH	LCN
2	KICK PLATES	8400	IVE
1	SET SEALS	2525	NGP
2	DOOR BOTTOMS	420N	NGP
1	MEETING EDGE SEAL	5060	NGP

HW SETS: 33 THROUGH 39 - RESERVED

ACCESS CONTROL DOORS AT INTERIOR LOCATIONS – HW SETS 40 THROUGH 45

HW SET: 40
DOOR NUMBER: 016C 020C 144B 255A 260E 260H 264C C210
EACH TO HAVE:

1	HINGES	5BB1HW	IVE
1	ELECTRIC HINGE	5BB1HW TW4	IVE
1	ELECTRONIC LOCKSET	45HM-7-DEU-14R IDH MAX	BES
1	SURFACE CLOSER	1461 CUSH FC	LCN
1	KICK PLATE	8400	IVE
1	SET SEALS	2525	NGP

COORDINATE INSTALLATION WITH SECURITY AND ELECTRICAL SYSTEMS

HW SET: 41
DOOR NUMBER: 024J 024K 126C 136C 149D
EACH TO HAVE:

5	HINGES	5BB1HW	IVE
1	ELECTRIC HINGE	5BB1HW TW4	IVE
2	MANUAL FLUSH BOLTS	FB458	IVE
1	DUST PROOF STRIKE	DP2	IVE
1	ELECTRONIC LOCKSET	45HM-7-DEU-14R IDH MAX	BES
2	SURFACE CLOSERS	1461 CUSH FC	LCN
2	KICK PLATES	8400	IVE
1	SET SEALS	2525	NGP
1	MEETING EDGE SEAL	5060	NGP

COORDINATE INSTALLATION WITH SECURITY AND ELECTRICAL SYSTEMS

HW SET: 42
DOOR NUMBER: 110A 112A 125 128 145D 154A 156B 180 296
EACH TO HAVE:

1	HINGES	5BB1HW	IVE
1	ELECTRIC HINGE	5BB1HW TW4	IVE
1	ELECTRONIC LOCKSET	45HM-7-DEU-14R IDH MAX	BES
1	SURFACE CLOSER	1461 REG FC	LCN
1	KICK PLATE	8400	IVE
1	FLOOR STOP	FS441	IVE
1	SET SEALS	2525	NGP

COORDINATE INSTALLATION WITH SECURITY AND ELECTRICAL SYSTEMS

HW SET: 43
DOOR NUMBER: C211
EACH TO HAVE:

3	HINGES	5BB1HW	IVE
1	POWER TRANSFER	EPT-10	VON
1	EXIT DEVICE	RX-EL98L	VON
1	CYLINDER	1E7	BES
-	CARD READER (WALL MT)	BEST ACCESS SYSTEMS - IDH MAX	BES
1	POWER SUPPLY	PS914	SCE
1	SURFACE CLOSER	1461 CUSH FC	LCN
1	KICK PLATE	8400	IVE

COORDINATE INSTALLATION WITH SECURITY AND ELECTRICAL SYSTEMS

HW SET: 44
DOOR NUMBER: 022 032
EACH TO HAVE:

5	HINGES	5BB1HW	IVE
1	ELECTRIC HINGE	5BB1HW TW4	IVE
2	MANUAL FLUSH BOLTS	FB458	IVE
1	DUST PROOF STRIKE	DP2	IVE
1	ELECTRONIC LOCKSET	45HM-7-DEU-14R IDH MAX	BES
2	SURFACE CLOSERS	1461 REG FC	LCN
2	KICK PLATES	8400	IVE
2	FLOOR STOPS	FS441	IVE

COORDINATE INSTALLATION WITH SECURITY AND ELECTRICAL SYSTEMS

HW SET: 45
DOOR NUMBER: C009A C212
EACH TO HAVE:

2	CONTINUOUS HINGES	224HD X EPT PREP	IVE
2	POWER TRANSFERS	EPT-10	VON
2	EXIT DEVICES	RX-EL9827L	VON
2	CYLINDERS	1E7	BES
-	CARD READER	BEST ACCESS SYSTEMS - IDH MAX	BES
1	POWER SUPPLY	PS914 X 900-2RS	SCE
2	SURFACE CLOSERS	4041 HCUSH	LCN
2	ARMOR PLATES	8400 34" H	IVE

COORDINATE INSTALLATION WITH SECURITY AND ELECTRICAL SYSTEMS

HW SET: 46
PROVIDE FOR THE OWNER'S SUPPORT & MAINTENANCE STOCK THE FOLLOWING ITEMS:

2	CLASSROOM LOCKS W/LEVER TRIM	L9070R	SCH
2	STOREROOM LOCKS W/LEVER TRIM	L9080R	SCH
2	SURFACE CLOSERS	1461	LCN
2	SURFACE CLOSERS	4041	LCN
1	KEY CABINET	AWC-150-S X SMTC W/ P84 CORE	
		STORAGE PANEL	TEL

HW SET: 47
FOR COORDINATION WITH SECURITY, ELECTRICAL AND ADA HARDWARE SYSTEMS, PROVIDE THE FOLLOWING SUPPORT AND TECHNICAL DATA, PREPARED FOR EACH HW SET INVOLVING ELECTRICAL HARDWARE:

1	SET WIRING DIAGRAMS
1	SET RISER DIAGRAMS
1	SET ELECTRICAL CATALOG DATA SHEETS
1	SET NARRATIVE DESCRIPTION DESCRIBING HARDWARE FUNCTIONS AND OPERATION

ALUMINUM DOORS AND FRAMES – HW SETS AL1 THROUGH AL8

HW SET: AL1
DOOR NUMBER: 024L C002 C104
EACH TO HAVE:

1	CONTINUOUS HINGES	224HD X EPT PREP	IVE
2	POWER TRANSFERS	EPT-10	VON
1	EXIT DEVICE	EL-RX3547A-EO	VON
1	EXIT DEVICE	EL-RX3547A-NL-OP	VON
1	CYLINDER	1E7	BES
-	CARD READER	BEST ACCESS SYSTEMS - IDH MAX	BES
1	POWER SUPPLY	PS914 X 900-2RS	SCE
2	DOOR POSITION SWITCHES	679-05 HM	SCE
2	OFFSET DOOR PULLS	8190-2-O	IVE
2	AUTO OPERATORS	4640 SERIES	LCN
1	ACTUATOR, WALL MOUNT	8310-856 (EXTERIOR)	LCN
1	ACTUATOR, WALL MOUNT	8310-856 (INTERIOR)	LCN
2	OVERHEAD STOPS	100S	GLY
1	THRESHOLD	613 RCE	NGP
-	SET SEALS	DOOR MFG STD INTEGRAL SEALS	
-	DOOR BOTTOM SEAL	DOOR MFG STD INTEGRAL SEALS	
-	MEETING EDGE SEAL	DOOR MFG STD INTEGRAL SEALS	

COORDINATE INSTALLATION WITH SECURITY AND ELECTRICAL SYSTEMS

HW SET: AL2
DOOR NUMBER: 024H
EACH TO HAVE:

1	CONTINUOUS HINGES	224HD X EPT PREP	IVE
2	POWER TRANSFERS	EPT-10	VON
1	EXIT DEVICE	EL-RX3547A-EO	VON
1	EXIT DEVICE	EL-RX3547A-NL-OP	VON
1	CYLINDER	1E7	BES
-	CARD READER	BEST ACCESS SYSTEMS - IDH MAX	BES
1	POWER SUPPLY	PS914 X 900-2RS	SCE
2	DOOR POSITION SWITCHES	679-05 HM	SCE
2	OFFSET DOOR PULLS	8190-2-O	IVE
2	SURFACE CLOSERS	4041 SCUSH X 4040-18PA X 4040-30 X 4040-61	LCN
1	THRESHOLD	613 RCE	NGP
-	SET SEALS	DOOR MFG STD INTEGRAL SEALS	
-	DOOR BOTTOM SEAL	DOOR MFG STD INTEGRAL SEALS	
-	MEETING EDGE SEAL	DOOR MFG STD INTEGRAL SEALS	

COORDINATE INSTALLATION WITH SECURITY AND ELECTRICAL SYSTEMS

HW SET: AL3
DOOR NUMBER: C108
EACH TO HAVE:

1	CONTINUOUS HINGE	224HD	IVE
1	EXIT DEVICE	35A-NL-OP	VON
1	CYLINDER	1E7	BES
1	DOOR POSITION SWITCH	679-05 HM	SCE
1	OFFSET DOOR PULL	8190-2-O	IVE
1	SURFACE CLOSER	4041 SCUSH X 4040-18PA X 4040-30 X 4040-61	LCN
1	THRESHOLD	613 RCE	NGP
-	SET SEALS	DOOR MFG STD INTEGRAL SEALS	
-	DOOR BOTTOM SEAL	DOOR MFG STD INTEGRAL SEALS	

COORDINATE INSTALLATION WITH SECURITY AND ELECTRICAL SYSTEMS

HW SET: AL4
DOOR NUMBER: C110 X201 X202
EACH TO HAVE:

1	CONTINUOUS HINGE	224HD	IVE
1	DEADLATCH	4900 X 4568 LEVER	ADA
1	CYLINDER	1E7	BES
1	DOOR POSITION SWITCH	679-05 HM	SCE
1	PUSH/PULL SET	9190-2-MO	IVE
1	SURFACE CLOSER	4041 HCUSH X 4040-18PA X 4040-30 X 4040-61	LCN
1	THRESHOLD	613 RCE	NGP
-	SET SEALS	DOOR MFG STD INTEGRAL SEALS	
-	DOOR BOTTOM SEAL	DOOR MFG STD INTEGRAL SEALS	

COORDINATE INSTALLATION WITH SECURITY AND ELECTRICAL SYSTEMS

HW SET: AL5
DOOR NUMBER: 231C 235C 241B 245C 249B 268C
EACH TO HAVE:

1	CONTINUOUS HINGE W/ELECTRIC THRU WIRE	224HD TW8	IVE
1	ELECTRONIC LOCKSET	45HM-7-DEU-14R IDH MAX	BES
1	DOOR POSITION SWITCH	679-05 HM	SCE
1	SURFACE CLOSER	1461 CUSH FC X 1461-18PA X 1460-30 X 1460-61	LCN
-	SET SEALS	DOOR MFG STD INTEGRAL SEALS	
-	DOOR BOTTOM SEAL	DOOR MFG STD INTEGRAL SEALS	

COORDINATE INSTALLATION WITH SECURITY AND ELECTRICAL SYSTEMS

HW SET: AL6
DOOR NUMBER: V005
EACH TO HAVE:

1	CONTINUOUS HINGE	224HD	IVE
1	EXIT DEVICE	35A-NL-OP	VON
1	CYLINDER	1E7	BES
1	DOOR POSITION SWITCH	679-05 HM	SCE
1	OFFSET DOOR PULL	8190-2-O	IVE
1	SURFACE CLOSER	4041 SCUSH X 4040-18PA X 4040-30 X 4040-61 LCN	
1	THRESHOLD	613 RCE	NGP
-	DOOR BOTTOM SEAL	DOOR MFG STD INTEGRAL SEALS	
-	MEETING EDGE SEAL	DOOR MFG STD INTEGRAL SEALS	

COORDINATE INSTALLATION WITH SECURITY AND ELECTRICAL SYSTEMS

HW SET: AL7
DOOR NUMBER: 024G
EACH TO HAVE:

2	CONTINUOUS HINGES	224HD	IVE
2	EXIT DEVICES	3547A-EO	VON
2	DOOR POSITION SWITCHES	679-05 HM	SCE
2	OFFSET DOOR PULLS	8190-2-O	IVE
2	SURFACE CLOSERS	4041 SCUSH X4040--614040-30 X 404018PA X	LCN
1	THRESHOLD	613 RCE	NGP
-	SET SEALS	DOOR MFG STD INTEGRAL SEALS	
-	DOOR BOTTOM SEAL	DOOR MFG STD INTEGRAL SEALS	
-	MEETING EDGE SEAL	DOOR MFG STD INTEGRAL SEALS	

COORDINATE INSTALLATION WITH SECURITY AND ELECTRICAL SYSTEMS

HW SET: AL8
DOOR NUMBER: 201A 201B
EACH SLIDING DOOR TO HAVE:

1	SET SLIDING DOOR TRACK	325	GRA
2	CARRIERS	113 424 7	GRA
2	ENDSTOP CATCHES	113 424 5	GRA
5	WALL MOUNTED BRACKETS	113 424 4	GRA
1	TRACK FASCIA	113 431 0	GRA
1	FLOOR GUIDE	050 562	GRA
1	HOOKBOLT DEADLOCK	MS1850S-050	ADA
1	CYLINDER	1E7 SERIES	BES
1	THUMBTURN CYLINDER	4066	ADA
1	SET DOOR PULLS	8102 X 8102 X 10” X MTG N	IVE

END OF SECTION 08710

SECTION 08800 - GLAZING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Glass.

B. Glazing compounds and accessories.

1.2 RELATED REQUIREMENTS

A. Section 06410 - Custom Cabinets: Cabinets with requirements for glass shelves.

B. Section 07900 - Joint Sealers: Sealant and back-up material.

C. Section 08110 - Steel Doors and Frames: Glazed doors and borrowed lites.

D. Section 08211 - Flush Wood Doors: Glazed doors.

E. Section 08410 - Metal-Framed Storefronts.

F. Section 08910 - Metal-Framed Curtain Wall.

1.3 REFERENCE STANDARDS

A. ASTM C 864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005.

B. ASTM C 920 - Standard Specification for Elastomeric Joint Sealants; 2010.

C. ASTM C 1048 - Standard Specification for Heat-Treated Flat Glass--Kind HS, Kind FT Coated and Uncoated Glass; 2004.

D. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2009.

E. ASTM E 1300 - Standard Practice for Determining Load Resistance of Glass in Buildings; 2009a.

F. ASTM E 2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation; 2008.

G. GANA (GM) - GANA Glazing Manual; Glass Association of North America; 2009.

H. GANA (SM) - FGMA Sealant Manual; Glass Association of North America; 2008.

1.4 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data on Glass Types: Provide structural, physical and environmental characteristics, size limitations, special handling or installation requirements.

C. Product Data on Glazing Compounds: Provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colors.

D. Samples: Submit two samples 12 in x 12 in size of glass units.

E. Certificates: Certify that products meet or exceed specified requirements.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 01600 - Product Requirements, for additional provisions.
2. Extra Insulating Glass Units: One of each glass size and each glass type.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with GANA Glazing Manual and FGMA Sealant Manual for glazing installation methods.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience.

1.6 FIELD CONDITIONS

A. Do not install glazing when ambient temperature is less than 50 degrees F.

B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.7 WARRANTY

A. See Section 01780 - Closeout Submittals, for additional warranty requirements.

B. Sealed Insulating Glass Units: Provide a five (5) year warranty to include coverage for seal failure, interpane dusting or misting, including replacement of failed units.

C. Laminated Glass: Provide a five (5) year warranty to include coverage for delamination, including replacement of failed units.

PART 2 - PRODUCTS

2.1 GLAZING TYPES

A. Refer to Glazing Schedule at the end of this section.

2.2 EXTERIOR GLAZING ASSEMBLIES

A. Structural Design Criteria: Select type and thickness to withstand dead loads and wind loads acting normal to plane of glass at design pressures calculated in accordance with ASCE 7.
1. Use the procedure specified in ASTM E1300 to determine glass type and thickness.
2. Limit glass deflection to 1/200 or flexure limit of glass, whichever is less, with full recovery of glazing materials.

B. Air and Vapor 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.
   2. To maintain a continuous air barrier and vapor retarder throughout the glazed assembly from glass pane to heel bead of glazing sealant.

2.3 GLASS MATERIALS

A. Float Glass Manufacturers:
   1. AGC Flat Glass North America, Inc: www.afgglass.com.
   2. Guardian Industries Corp: www.sunguardglass.com.
   3. Pilkington North America Inc: www.pilkington.com/na.
   4. PPG Industries, Inc: www.ppgglazing.com.
   5. Viracon
   6. Substitutions: Refer to Section 01600 - Product Requirements.

B. Float Glass: All glazing is to be tempered float glass unless otherwise indicated.
   1. Heat-Strengthened and Fully Tempered Types: ASTM C1048.
   2. Tinted Types: Color and performance characteristics as indicated.
   3. Thicknesses: As indicated; for exterior glazing comply with specified requirements for wind load design regardless of specified thickness.

C. Clear Float Glass: Clear, heat-strengthened and fully-tempered.
   1. Comply with ASTM C 1036, Type I, transparent flat, Class 1 clear, Quality Q3 (glazing select).
   2. Comply with ASTM C 1048.
   3. 1/4" (6 mm) minimum thick, 1/2" thick only where butt-glazed.

D. Safety Glass: Clear; fully tempered with horizontal tempering.
   1. At laminated glass provide 0.060 inch thick plastic interlayer; comply with ASTM C 1172
   2. Comply with ASTM C 1036, Type I, transparent flat, Class 1 clear, Quality Q3 (glazing select) and ASTM C 1048.
   3. Comply with 16 CFR 1201 test requirements for Category II.
   4. 6 mm minimum thick (each layer).

E. Tinted Glass: Float type, heat strengthened, color as indicated.
   1. Comply with ASTM C 1036, Type I, transparent flat, Class 2, Quality Q3 (glazing select).
   2. Comply with ASTM C 1048.
   3. 6 mm minimum thick.

F. Low E Glass: Float type, heat strengthened, color as indicated.
   1. Coating on inner surface.
   2. Comply with ASTM C 1036, Type I, transparent flat, Quality Q3 (glazing select).
   3. Comply with ASTM C 1048.
   4. 6 mm thick.

G. Spandrel Glass: Heat strengthened, clear.
   1. Ceramic fused frit on back surface. Color to be selected by Architect from manufacturers standard colors available.
   2. Comply with ASTM C 1036 Type I, transparent flat, Quality Q3.
   3. Comply with ASTM C 1048.
   4. 6 mm thick.

H. Patterned Glass:
   1. Comply with ASTM C 1036, Type II (patterned flat glass), obscured.
   2. Location: Provide obscured glazing at all office door vision lites.

2.4 SEALED INSULATING GLASS UNITS

A. Manufacturers:
   1. Any of the manufacturers specified for float glass.
   2. Substitutions: Refer to Section 01600 - Product Requirements.

B. Sealed Insulating Glass Units: Types as indicated.
   1. Kind FT: Fully tempered everywhere
   2. Solar Control Low-E Coating: Sputtered on second surface.
   3. Durability: Certified by an independent testing agency to comply with ASTM E2190.
   4. Edge Spacers: Aluminum, bent and soldered corners.
   5. Edge Seal: Glass to elastomer with supplementary silicone sealant.
   6. Purge interpane space with dry hermetic air.

2.5 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 Construction Chemicals-Building Systems: www.chemrex.com.
   5. Substitutions: Refer to Section 01600 - Product Requirements.

B. Glazing Putty: Polymer modified latex recommended by manufacturer for outdoor use, knife grade consistency; grey color.

C. Butyl Sealant: Single component; ASTM C 920, Grade NS, Class 12-1/2, Uses M and A; Shore A hardness of 10 to 20; black color; non-skinning.

D. Silicone Sealant: Single component; neutral curing; capable of water immersion without loss of properties; non-bleeding, non-staining; ASTM C 920, Type S, Grade NS, Class 25, Uses M, A, and G; cured Shore A hardness of 15 to 25; color as selected.

2.6 GLAZING ACCESSORIES

A. Setting Blocks: Neoprene, 80 to 90 Shore A durometer hardness, ASTM C 864 Option I. Length of 0.1 inch for each square foot of glazing or minimum 4 inch x width of glazing rabbet space minus 1/16 inch x height to suit glazing method and pane weight and area.

B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness, ASTM C 864 Option I. Minimum 3 inch long x one half the height of the glazing stop x thickness to suit application, self adhesive on one face.

C. Glazing Tape: Preformed butyl compound with integral resilient tube spacing device; 10 to 15 Shore A durometer hardness; coiled on release paper; black color.

D. Glazing Gaskets: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C 864 Option I; .

E. Glazing Clips: Manufacturer's standard type.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that openings for glazing are correctly sized and within tolerance.

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

3.2 PREPARATION

A. Prime surfaces scheduled to receive sealant.

B. Install sealants in accordance with ASTM C1193 and FGMA Sealant Manual.

C. Install sealant in accordance with manufacturer's instructions.

3.3 GLAZING METHODS

3.4 INSTALLATION - EXTERIOR DRY METHOD (TAPE AND GASKET SPLINE GLAZING)

A. Cut glazing tape to length; install on glazing pane. Seal corners by butting tape and sealing junctions with butyl sealant.

B. Place setting blocks at 1/4 points with edge block no more than 6 inches from corners.

C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure to attain full contact.

D. Install removable stops without displacing glazing spline. Exert pressure for full continuous contact.

E. Trim protruding tape edge.

3.5 INSTALLATION - INTERIOR DRY METHOD (TAPE AND TAPE)

A. Cut glazing tape to length and set against permanent stops, projecting 1/16 inch (1.6 mm) above sight line.

B. Place setting blocks at 1/4 points with edge block no more than 6 inches from corners.

C. Rest glazing on setting blocks and push against tape for full contact at perimeter of pane or unit.

D. Place glazing tape on free perimeter of glazing in same manner described above.

E. Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.

F. Knife trim protruding tape.

3.6 MANUFACTURER'S FIELD SERVICES

A. Glass and Glazing product manufacturers to provide field surveillance of the installation of their products.

B. Monitor and report installation procedures and unacceptable conditions.

3.7 CLEANING

A. Remove glazing materials from finish surfaces.

B. Remove labels after Work is complete.

C. Clean glass and adjacent surfaces.

3.8 PROTECTION

A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.

3.9 SCHEDULE

A. Aluminum Curtain Wall: Thicknesses required to comply with performance requirements, exterior dry method.

1. Type 1: Ultra-Clear, Low-E, Insulating Glass, 1" (25 mm) thick overall.
   a. 1/4" (6 mm) ultra-clear, Low-E on #2 surface.
   b. 1/2" (13.2 mm) airspace.
   c. 1/4" (6 mm) clear.
   d. Basis of Design: PPG Solarban 70XL on Starphire Ultra-Clear Glass with the following qualities:

1)	Transmittance:	Ultra-Clear/Clear
	(a) Visible Light	64
	(b) Solar Energy	25
	(c) Ultra-Violet	6
2)	Reflectance	
	(a) Visible Light-Exterior	12
	(b) Visible Light-Interior	12
	(c) Solar Energy	52
3)	ASHRAE U-Value	
	(a) Winter Nighttime	0.28
	(b) Summer Daytime	0.26
4)	European U-Value:	1.50
5)	Shading Coefficient:	0.32
6)	Solar Factor (SHGC):	0.27
7)	LSG:	2.37

B. Sloped Glazing
   1. Same as above, except laminated safety glass at inside glazing.

END OF SECTION 08800

SECTION 08910 - METAL-FRAMED CURTAIN WALL

PART 1 - GENERAL

1.1 SUMMARY

A. Related Documents: Conditions of the Contract, Division 1 - General Requirements, and Drawings apply to Work of this Section.

B. Section Includes:
1. Aluminum curtain wall system, complete with, reinforcing, shims, anchors, and attachment devices.
2. Sloped aluminum glazed system.
3. Sunshades.

C. Related Sections:
1. Section 05500 - Metal Fabrications.
2. Section 06100 - Rough Carpentry.
3. Section 07900 - Joint Sealers.
4. Section 08410 - Aluminum Entrances.
5. Section 08810 - Glass and Glazing.

1.2 REFERENCES

A. Aluminum Association (AA):
1. DAF-45 Designation System for Aluminum Finishes.

B. American Architectural Manufacturers Association (AAMA):
1. CW-DG-1 Aluminum Curtain Wall Design Guide Manual.
2. 501Methods of Test for Exterior Walls
3. 501.2 Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls and Sloped Glazing Systems.
4. 611 Voluntary Specification for Anodized Architectural Aluminum.
5. 1503 Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors, and Glazed Wall Sections.
6. 2605 Voluntary Specification Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Architectural Extrusions and Panels.
7. TIR-A8 Structural Performance of Composite Thermal Barrier Framing Systems.

C. American National Standards Institute (ANSI):
1. Z97.1 Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test.

D. American Society for Testing and Materials (ASTM):
1. A36 Structural Steel.
2. A123 Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
3. A525 General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
4. A526 Sheet Steel, Zinc Coated (Galvanized) by the Hot-Dip Process, Commercial Quality.

5. B209 Aluminum and Aluminum-Alloy Sheet and Plate.
6. B221 Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.
7. B308 Aluminum-Alloy 6061-T6 Standard Structural Shapes, Rolled or Extruded.
8. C716 Installing Lock-Strip Gaskets and Infill Glazing Materials.
9. C920 Elastomeric Joint Sealants.
10. E283 Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors.
11. E330 Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
12. E331 Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
13. E773 Test Method for Seal Durability of Sealed Insulating Glass Units.
14. E774 Sealed Insulating Glass Units.

E. Consumer Product Safety Commission (CPSC):
1. 16 CFR 1201 Safety Standard for Architectural Glazing Materials.

F. Federal Specifications (FS):
1. TT-P-645A Primer, Paint, Zinc Chromate, Alkyd Type.

G. Glass Association of North America (GANA):
1. Glazing Manual.

H. Steel Structures Painting Council (SSPC):
1. SP 2 Hand Tool Cleaning
2. SP 3 Power Tool Cleaning
3. PS Guide 12.00 Guide to Zinc-Rich Coating Systems

1.3 SYSTEM REQUIREMENTS

A. General Standard: In addition to requirements shown or specified, comply with applicable provisions of Aluminum Curtain Wall Design Guide Manual for design, materials, fabrication and installation of component parts.

B. Design Requirements:
1. Metal stick-framed systems with interior and exterior exposed metal framing.
2. Operable vent with sight line concealed from the exterior.
3. System manufacturer shall provide low profile entrance frames.
4. System manufacturer shall provide curtain wall systems, including necessary modifications to meet specified requirements and maintaining visual design concepts.
5. Fabricate glazing systems for interior glazing.
6. Perimeter conditions shall allow for installation tolerances, expansion and contraction of adjacent materials, and sealant manufacturer's recommended joint design.
7. Drawings are diagrammatic and do not purport to identify nor solve problems of thermal or structural movement, glazing, anchorage or moisture disposal.
8. Requirements shown by details are intended to establish basic dimension of unit, sight lines and profiles of members.
9. Do not assume glass, sealants, and interior finishes contribute to framing member strength, stiffness, or lateral stability.

10. Attachment considerations are to take into account site peculiarities and expansion and contraction movements so there is no possibility of loosening, weakening or fracturing connection between units and building structure or between units themselves.
11. Anchors, fasteners and braces shall be structurally stressed not more than 50% of allowable stress when maximum loads are applied.
12. Allow for expansion and contraction due to structural movement without detriment to appearance or performance.
13. System shall drain to exterior face of wall, water entering joints and condensation occurring within system by drain holes and gutters of adequate size to evacuate water without infiltration to interior or the top of lower lites of glass.
14. Provide concealed fastening.
15. Metal faces are required to be visually flat under all lighting conditions, subject to acceptance of Architect.
16. Provide uniform color and profile appearance at components exposed to view.
17. Provide exterior dense EPDM [closed cell EPDM sponge] gasket with a maximum 30% compression when glazed, to create a water and air seal. Provide interior dense EPDM wedge gasket with sealed corners, with maximum 30% compression when glazed, to create a water and air seal.
18. Provide composite horizontal and vertical mullions consisting of aluminum extrusions with glass-reinforced polyamide insulating strips.
19. Not Permitted: Vibration harmonics, wind whistles, noises caused by thermal movement, thermal movement transmitted to other building elements, loosening, weakening, or fracturing of attachments or components of system.

C. Performance Requirements:
1. Air infiltration: Air leakage shall not exceed 0.06 cfm per square foot of surface area when tested in accordance with ASTM E283 at differential static pressure of 6.24 psf.
2. Water Resistance (static): No uncontrolled leakage when tested in accordance with ASTM E331 at test pressure of 15.0 psf as defined in AAMA 501.
3. Water Resistance (dynamic): No uncontrolled leakage when tested in accordance with AAMA 501.1 at test pressure equivalent of 15.0 psf as defined in AAMA 501
4. Uniform Load: A static air design load of 40 psf shall be applied in a positive and negative direction in accordance with ASTM E 330. At structural test load equal to 1.5 times the specified design load, no glass breakage or permanent set in the framing members in excess of 0.2% of their clear spans shall occur.

D. Structural Requirements:
1. Wind loading: 90 mph.
2. Deflection under uniform loading: When tested in accordance with ASTM E330 at design pressure, maximum deflection of exterior member shall not exceed L/175 of spans up to 13'-6", or L/240 + 1/4" for spans greater than 13'-6".
3. Parallel to wall and corner mullion deflections: 75% of glass edge bite or 3/8 inch, whichever is less.
    a. Anchors to building structure and
    b. Horizontal glazing rails or interior trim, which are in actual contact with compression flange.
4. Do not regard points of contra-flexure as lateral braces or as end points of un-braced length; un-braced length is actual distance between effective lateral braces as defined above.

5. Where framing member reaction is resisted by continuous element, maximum assumed effective length of the resisting element is 4 times bearing length, but not more than 12 inches.
6. Structural Performance of composite vertical mullions shall be analyzed based on AAMA TIR-A8 Structural Performance of Composite Thermal Barrier Framing Systems.

E. Thermal Requirements: Framing systems shall accommodate expansion and contraction movement due to surface temperature differential of 180°F without causing buckling, stress on glass, failure of joint seals, excessive stress on structural elements, reduction of performance or other detrimental effects.

F. Thermal Transmittance (U-factor): When tested to AAMA Specification 1503, the thermal transmittance (U-Factor) shall not be more than [.35 (with Low-e glass, e=0.40)] [.57 (with clear glass)].

G. Condensation Resistance (CRF): When tested to AAMA Specification 1503, the condensation resistance factor shall not be less than [78 frame and 71 glass (with Low-e glass, e=0.40)] [76 frame and 59 glass (with clear glass)].

H. Seismic: When tested to AAMA 501.4, system must meet design displacement of 0.010 x the story height and ultimate displacement of 1.5 x the design displacement, 0.015 x the story height, and 0.025 x the story height.

I. Sound Transmission: When tested to ASTM E90, the Sound Transmission Class (STC) shall not be less than 35 based upon 1" insulating glass (1/4", 1/2" AS, 1/4"); OR, not less than 39 based upon 1" insulating glass (1/4" Lam, 1/2" AS, 1/4" Lam).

J. Laboratory Testing: Refer to Section 01411 for requirements.

K. Interface:
1. Furnish inserts and anchoring devices, which need to be preset and built into structure to appropriate trade.
2. Supply on timely basis to avoid delay in Work.
3. Instruct other trades of proper location and position.
4. Furnish setting drawings, diagrams, templates and installation instructions.

1.4 SUBMITTALS

A. General: Submit in accordance with Section 01300.

B. Product Data:
1. Submit manufacturer's descriptive literature for each manufactured products.
2. Include information for factory finishes, accessories and other required components.
3. Include color charts for finish indicating manufacturer's standard colors available for selection.

4. Shop Drawings:
   a. Submit drawings indicating elevations, detailed design, dimensions, member profiles, joint locations, arrangement of units, member connections, and thickness of various components.
   b. Show following items:
      1) Details of special shapes.
      2) Reinforcing.
      3) Drainage details and flow diagrams.
      4) Anchorage system.
      5) Interfacing with building construction.
      6) Provisions for system expansion and contraction
      7) Thermal breaks.
      8) Indicate glazing details, methods, locations of various types and thickness of glass, operable sash locations, and internal sealant requirements.
      9) Clearly indicate locations of exposed fasteners and joints for Architect's acceptance.
      10) Clearly show where and how manufacturer's system deviates from Contract Drawings and these Specifications.

C. Samples:
   1. Submit manufactures samples indicating quality of finish in required colors.
   2. Where normal texture or color variations are expected, include additional samples illustrating range of variation.

D. Test Reports: Submit certified copies of previous tests reports by independent laboratory substantiating performance of system. Include other supportive data as necessary.

E. Warranty: Submit specified warranties.

1.5 QUALITY ASSURANCE

A. Single Source Responsibility:
   1. Provide curtainwall systems that are products of a single manufacturer.

B. Engineer Qualifications: Professional Structural Engineer registered in State where Project is located.

C. Installer Qualifications: Certified in writing by system manufacturer as qualified for specified systems.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of Section 01600.

B. Protect finished surfaces to prevent damage.

C. Do not use adhesive papers or sprayed coatings, which become firmly bonded when exposed to sun.

D. Do not leave coating residue on surfaces.

1.7 PROJECT CONDITIONS

A. Ensure ambient and surface temperatures and joint conditions are suitable for installation of materials.

1.8 WARRANTY

A. Provide warranties in accordance with Section 01770.

B. Provide written warranty in form acceptable to Owner jointly signed by manufacturer, installer and Contractor warranting work to be watertight, free from deflective materials, defective workmanship, glass breakage due to defective design, and agreeing to replace components which fail within 2 years from date of Substantial Completion.

C. Warranty shall cover following:
1. Complete watertight and airtight system installation within specified tolerances.
2. Glass and glazing gaskets will not break or "pop" from frames due to design wind, expansion or contraction movement or structural loading.
3. Glazing sealants and gaskets will remain free from abnormal deterioration or dislocation due to sunlight, weather or oxidation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Subject to compliance with requirements indicated, provide products by one of the following:
1. Vistawall Architectural Products.
2. Kawneer Company, Inc.
3. United States Aluminum Corp.

B. Substitutions: Submit under provisions of Section 01330, a minimum of 10 days prior to bid date.

2.2 Design Basis: Kawneer curtain wall systems as follows:

A. Curtain Wall Types:
1. Kawneer 1600 - System 1, 1” Glazing, 2-1/2" x 6" mullion profiles, exterior glazed, stick wall system with polyamide strip thermal break in vertical and horizontal members.
2. Kawneer 1600 (Interior only) - 1/4" Glazing, 2-1/2" x 6" mullion profiles, no thermal break.
3. Sloped Alumium Glazed System: Kawneer 1600 SG, 1” Glazing, 2-1/2" x 6" mullion profiles, flush grid exterior.
4. Sunshade: Kawneer 1600 Sunshade.
   a. Outrigger: Straight with rounded ends.
   b. Louver Blade: Airfoil type.

2.3 FRAMING MATERIALS AND ACCESSORIES

A. Aluminum:
1. ASTM B221, alloy 6063-T6 for extrusions; ASTM B209, alloy 5005-H16 for sheets; or other alloys and temper recommended by manufacturer appropriate for specified finish.

B. Internal Reinforcing:
1. ASTM A36 for carbon steel; or ASTM B308 for structural aluminum.
2. Shapes and sizes to suit installation.
3. Shop coat steel components after fabrication with alkyd type zinc chromate primer complying with FS TT-P-645.

C. Inserts and Anchorage Devices:
1. Manufacturer's standard formed or fabricated assemblies, steel or aluminum, of shapes, plates, bars or tubes.
2. Hot-dip galvanize steel assemblies after fabrication comply with ASTM A123, 2.0 ounce minimum coating.

D. Fasteners:
1. Non-magnetic stainless steel or cadmium plated steel coated with yellow or silver iridescence plating, compatible with materials being fastened.
2. Series 300 stainless steel for exposed locations. Cadmium plated steel with 0.0005 inch
3. plating thickness and color chromate coated for concealed locations.
4. Provide nuts or washers of design having the means to prevent disengagement; deforming of fastener threads is not acceptable.
5. Provide concealed fasteners wherever possible.

E. Expansion Anchor Devices: Lead-shield or toothed-steel, drilled-in, expansion bolt anchors.

F. Shims: Non-staining, non-ferrous, type as recommended by system manufacturer.

G. Protective Coatings: Cold applied asphalt mastic complying with SSPC-Paint 12, compounded for 30 mil thickness for each coat; or alkyd type zinc chromate primer complying with FS TT-P-645.

H. Glazing Gaskets:
1. Compression type design, exterior replaceable, extruded EPDM. Interior is a dense EPDM closed cell EPDM sponge gasket.
2. Comply with ASTM C509 or C864.
3. Profile and hardness as necessary to maintain uniform pressure for watertight seal.
4. Manufacturer's standard black color.

I. Internal Sealants: Types recommended by system manufacturer to remain permanently elastic, tacky, non-drying, non-migrating and weather-tight.

2.4 GLASS AND GLAZING ACCESSORIES

A. Refer to Section 08810.

2.5 SYSTEM FABRICATION

A. Take accurate field measurements to verify required dimensions prior to fabrication.

B. Location of exposed joints is subject to Architect's acceptance.

C. Provide dense EPDM continuous isolator at pressure plated members to separate exterior pressure plates and interior framing members.

D. Fabricate components in accord with approved shop drawings. Remove burrs and ease edges. Shop fabricate to greatest extent practicable to minimize field cutting, splicing, and assembly. Disassemble only to extent necessary for shipping and handling limitations.

E. Steel Components:

1. Clean surfaces after fabrication and immediately prior to application of primer in accord with SSPC-SP2 or SSPC-SP3 at manufacturer's option.
2. Apply specified shop coat primer in accord with manufacturer's instructions to provide 2.0 minimum dry film thickness.

F. Fabricate components true to detail and free from defects impairing appearance, strength or durability. Fabricate custom extrusions indicated and as necessary for complete installation.

G. Fabricate components to allow for accurate and rigid fit of joints and corners. Match components carefully ensuring continuity of line and design. Ensure joints and connections will be flush and weather-tight. Ensure slip joints make full, tight contact and are weather- tight.

H. Reinforce components as required at anchorage and support points, at joints, and at attachment points for interfacing work.

I. Provide structural reinforcing within framing members where required to maintain rigidity and accommodate design loads.

J. System design and sealants to accommodate internal weep and drainage system not visible to the exterior.

K. Allow for adequate clearance around perimeter of system to enable proper installation and for thermal movement within system.

L. Separate dissimilar metals with protective coating or preformed separators to prevent contact and corrosion.

M. Provide framing members to rigidly glaze spandrel panels and column covers within framing system.

N. Provide special shapes and filler pieces with tight corners.

2.6 FINISH

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

C. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: non-specular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions and proceed with Work in accordance with Section 01400.

B. Verify dimensions, tolerances, and method of attachment with other Work.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions and applicable provisions of AAMA Aluminum Curtain Wall Design Guide Manual.

B. Align assemblies plumb and level, free of warp or twist, aligning with adjacent work.

C. Tolerances:
1. Limit variations from plumb and level:
   a. 1/8 inch in 20'-0" vertically and horizontally.
   b. 1/4 inch in 40'-0" either direction.
2. Limit offsets in theoretical end-to-end and edge-to-edge alignment:
   a. 1/16 inch where surfaces are flush or less than 1/2 inch out of flush and separated by not more than 2 inches.
   b. 1/8 inch for surfaces separated by more than 2 inches.
3. Step in face: 1/16 inch maximum.
4. Jog in alignment: 1/16 inch maximum.
5. Location: 1/4 inch maximum deviation of any member at any location.
6. Tolerances are not accumulative.

D. Provide attachments and shims to permanently fasten system to building structure.

E. Anchor securely in place, allowing for required movement, including expansion and constriction.

F. Separate dissimilar materials at contract points, including metal in contact with masonry or concrete surfaces, with protective coating or preformed separators to prevent contact and electrolytic action.

G. Set sill members in bed of sealant. Set other members with internal sealants and baffles to provide weather-tight construction.

H. Water Drainage: Each light of glass shall be compartmentalized using joint plugs and silicone sealant to divert water to the horizontal weep locations. Weep holes shall be located in the horizontal pressure plates and covers to divert water to the exterior of the building.

I. Ensure that dead load from curtain wall system is not transferred to masonry veneer.

J. Glazing:
1. Install glazing gaskets and sealants in accordance with manufacturer's instructions without exception; including surface preparations. Refer to Section 08810 for additional requirements.
2. Outside glazed and held in place with extruded aluminum pressure plates anchored to the mullion using Drill-Flex fasteners spaced no greater than 9” on center.

3.3 FIELD QUALITY CONTROL

A. Field Tests: Independent testing laboratory will perform air infiltration, water infiltration, and hose test; refer to Section 01411 for requirements.

3.4 CLEANING

A. Clean surfaces in compliance with manufacturer's recommendations; remove excess mastic, mastic smears, and other foreign materials.

B. Clean metal surfaces exercising care to avoid damage.

END OF SECTION 08910

SECTION 09260 - GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Performance criteria for gypsum board assemblies.

B. Metal stud wall framing.

C. Metal channel ceiling framing.

D. Shaft wall system.

E. Acoustic insulation.

F. Cementitious backing board.

G. Gypsum wallboard.

H. Joint treatment and accessories.

I. Water-resistive barrier over exterior wall sheathing.

J. Acoustic (sound-dampening) ceiling board with isolation hangers.

1.2 RELATED REQUIREMENTS

A. Section 05400 - Cold Formed Metal Framing: Exterior wind-load-bearing metal stud framing.

B. Section 06100 - Rough Carpentry: Building framing and sheathing.

C. Section 06100 - Rough Carpentry: Wood blocking product and execution requirements.

D. Section 07900 - Joint Sealers: Acoustic sealant.

E. Section 09300 - Tiling: Tile backing board.

1.3 REFERENCE STANDARDS

A. AISI SG02-1 - North American Specification for the Design of Cold-Formed Steel Structural Members; American Iron and Steel Institute; 2001 with 2004 supplement. (replaced SG-971)

B. ANSI A108.11 - American National Standard for Interior Installation of Cementitious Backer Units; 1999 (R2005).

C. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units; 1999 (R2005).

D. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or

Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2009a.

E. ASTM C 475/C 475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2002 (Reapproved 2007).

F. ASTM C 645 - Standard Specification for Nonstructural Steel Framing Members; 2009a.

G. ASTM C 665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2006.

H. ASTM C 754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2009a.

I. ASTM C 840 - Standard Specification for Application and Finishing of Gypsum Board; 2008.

J. ASTM C 954 - 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; 2007.

K. ASTM C 1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base; 2009.

L. ASTM C 1325 - Standard Specification for Non-Asbestos Fiber-Mat Reinforced Cement Substrate Sheets; 2008b.

M. ASTM C 1396/C 1396M - Standard Specification for Gypsum Board; 2009a.

N. ASTM C 1629/C 1629 - Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels; 2006.

O. ASTM D 3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2000 (Reapproved 2005).

P. ASTM E 72 - Standard Test Methods of Conducting Strength Tests of Panels for Building Construction; 2005.

Q. ASTM E 90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009.

R. ASTM E 413 - Classification for Rating Sound Insulation; 2004.

S. GA-216 - Application and Finishing of Gypsum Board; Gypsum Association; 2010.

T. GA-226 - Application of Gypsum Board to Form Curved Surfaces; Gypsum Association; 2008.

U. GA-600 - Fire Resistance Design Manual; Gypsum Association; 2009.

V. UL (FRD) - Fire Resistance Directory; Underwriters Laboratories Inc.; current edition.

1.4 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate special details associated with fireproofing and acoustic seals. Also provide elevations indicating proposed locations of control joints including at door and window heads.

C. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

D. Test Reports: For all stud framing products that do not comply with ASTM C 645 or C 754, provide independent laboratory reports showing maximum stud heights at required spacings and deflections.

E. LEED Submittals:

1. For gypsum wallboard, submit documentation of recycled content and location of manufacture.

2. For steel products, submit documentation of steel mill process, location of mill, and location of manufacture.

PART 2 - PRODUCTS

2.1 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C 840 and GA-216.

B. Interior Partitions Indicated as Acoustic: Provide completed assemblies with the following characteristics:

1. Acoustic Attenuation: STC of 45-49 calculated in accordance with ASTM E 413, based on tests conducted in accordance with ASTM E 90.

C. Shaft Walls at HVAC Shafts: Provide completed assemblies with the following characteristics:

1. Air Pressure Within Shaft: Sustained loads of 5 lbf/sq ft with maximum mid-span deflection of L/240.
2. Acoustic Attenuation: STC of 35-39 calculated in accordance with ASTM E 413, based on tests conducted in accordance with ASTM E 90.

D. Shaft Walls at Elevator Shafts: Provide completed assemblies with the following characteristics:

1. Air Pressure Within Shaft: Intermittent loads of 5 lbf/sq ft with maximum mid-span deflection of L/240.
2. Acoustic Attenuation: STC of 35-39 calculated in accordance with ASTM E 413, based on tests conducted in accordance with ASTM E 90.

E. Fire Rated Assemblies: Provide completed assemblies with the following characteristics:

1. UL Assembly Numbers: Provide construction equivalent to that listed for the particular assembly in the current UL Fire Resistance Directory.

2.2 METAL FRAMING MATERIALS

A. Manufacturers - Metal Framing, Connectors, and Accessories:
1. Clarkwestern Dietrich Building Systems LLC: www.clarkdietrich.com.
2. Dietrich Metal Framing: www.dietrichindustries.com.
3. Marino\Ware: www.marinoware.com.
4. Substitutions: See Section 01600 - Product Requirements.

B. Non-Loadbearing Framing System Components: ASTM C 645; galvanized sheet steel, of size and properties necessary to comply with ASTM C 754 for the spacing indicated, with maximum deflection of wall framing of L/240 at 5 psf.
1. Exception: The minimum metal thickness and section properties requirements of ASTM C 645 are waived provided steel of 40 ksi minimum yield strength is used, the metal is continuously dimpled, the effective thickness is at least twice the base metal thickness, and maximum stud heights are determined by testing in accordance with ASTM E 72 using assemblies specified by ASTM C 754.
2. Studs: "C" shaped with flat or formed webs with knurled faces.
3. Runners: U shaped, sized to match studs.
4. Ceiling Channels: C shaped.
5. Furring: Hat-shaped sections, minimum depth of 7/8 inch.
6. Resilient Furring Channels: 1/2 inch depth, for attachment to substrate through one leg only.

C. Shaft Wall Studs and Accessories: ASTM C 645; galvanized sheet steel, of size and properties necessary to comply with ASTM C 754 and specified performance requirements.

D. Ceiling Hangers: Type and size as specified in ASTM C 754 for spacing required.

E. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection using slotted holes, screws and anti-friction bushings, preventing rotation of studs while maintaining structural performance of partition.
1. Structural Performance: Maintain lateral load resistance and vertical movement capacity required by applicable code, when evaluated in accordance with AISI North American Specification for the Design of Cold-Formed Steel Structural Members.
2. Material: ASTM A 653/A 653M steel sheet, SS Grade 50/340, with G60/Z180 hot dipped galvanized coating.
3. Provide components UL-listed for use in UL-listed fire-rated head of partition joint systems of fire rating and movement required.
4. Deflection and Firestop Track:
    a. Provide mechanical anchorage devices as described above that accommodate deflection while maintaining the fire-rating of the wall assembly.

2.3 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board:
1. Georgia-Pacific Gypsum LLC: www.gp.com/gypsum.
2. National Gypsum Company: www.nationalgypsum.com.
3. USG Corporation: www.usg.com.
4. Substitutions: See Section 01600 - Product Requirements.

B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C 1396/C 1396M; sizes to minimize joints in place; ends square cut.

1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
2. Mold Resistance: Score of 10, when tested in accordance with ASTM D 3273.
   a. Mold-resistant board is required whenever board is being installed before the building is enclosed and conditioned.
3. Thickness:
   a. Vertical Surfaces: 5/8 inch.
   b. Ceilings: 5/8 inch.

C. Impact-Rated Wallboard: Tested to Level 3 soft-body and hard-body impact in accordance with ASTM C 1629.

1. Application: High-traffic areas indicated.
2. Type: Fire-resistance rated Type X, UL or WH listed.
3. Thickness: 5/8 inch.
4. Edges: Tapered.

D. Backing Board For Wet Areas:

1. Application: Surfaces behind tile in wet areas including tub and shower surrounds and shower ceilings.
2. Mold Resistance: Score of 10, when tested in accordance with ASTM D 3273.
3. 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 C 1325.
   a. Thickness: 1/2 inch.

E. Backing Board For Non-Wet Areas: Water-resistant gypsum backing board as defined in ASTM C 1396/C 1396M; sizes to minimum joints in place; ends square cut.

1. Application: Vertical surfaces behind thinset tile, except in wet areas.
2. Mold Resistance: Score of 10, when tested in accordance with ASTM D 3273.
3. Type: Regular and Type X, in locations indicated.
4. Type X Thickness: 5/8 inch.
5. Regular Board Thickness: 5/8 inch.
6. Edges: Tapered.

F. Acoustical Sound Dampening Ceiling Board: Two layers of heavy paper faced, high density gypsum board separated by a viscoelastic polymer layer and capable of achieving STC rating of 50 or more in typical noise control ceiling assemblies as calculated in accordance with ASTM E 413 and when tested in accordance with ASTM E 90.

1. Thickness: 5/8 inch.
2. Long Edges: Tapered.
3. Mold Resistance: Score of 10, when tested in accordance with ASTM D 3273.

G. Exterior Sheathing Board: As specified in Section 06100.

H. Shaftwall and Coreboard: Type X; 1 inch thick by 24 inches wide, beveled long edges, ends square cut.

1. Paper Faced Type: Gypsum shaftliner board or gypsum coreboard as defined ASTM C 1396/C 1396M; water-resistant faces.

2.4 ACCESSORIES

A. Acoustic Insulation: ASTM C 665; preformed glass fiber, friction fit type, unfaced. Thickness: 2 inches.

B. Acoustic Ceiling Board Isolation Hangers:

1. Isolation hangers shall be equal to Model ICC manufactured by Kinetics Noise Control, Inc. Dublin, Ohio.

2. The isolation hanger shall be a combination high-deflection steel spring in series with a resilient, molded neoprene noise and vibration isolation pad. The steel spring and neoprene pad shall be incorporated into a stamped steel hanger assembly that resiliently supports the isolated ceiling.

3. The hanger assembly bracket shall be designed to allow fifteen (15) degrees of vertical alignment of the suspension member without making metal-to-metal contact between the suspension and hanger assembly members. The hanger bracket shall be designed with an integral spring pre-load bracket selected to minimize change in elevation once a load is applied to the hanger and to hold the isolator assembly steady during attachment of gypsum board. The hanger assembly bracket shall consist of a leveling rod with an attached channel carrier designed to accept 1-1/2" x 1/2", 16-gauge cold-rolled steel. The isolation hanger deflection shall be selected by the manufacturer to provide a maximum natural frequency of 4.4 Hz. The steel spring element shall have a minimum Kx to Ky of 1 at its 1" rated deflection.

4. Isolated suspended ceilings shall be separated where non-isolated building components abut. Isolation material shall be equal to 3/8" thick Model SRP perimeter isolation board. Model SRP shall not be penetrated by nail, screw, or similar fastener. Model SRP shall be adhered to non-isolated structure. Resiliently-suspended ceiling shall be constructed against Model SRP. Model SRP shall be sealed using resilient, non- hardening caulk.

C. Acoustic Sealant: Non-hardening, non-skinning, for use in conjunction with gypsum board.

D. Water-Resistive Barrier: No. 15 asphalt felt.

E. Finishing Accessories: ASTM C 1047, galvanized steel or rolled zinc, unless otherwise indicated.

1. Types: As detailed or required for finished appearance.

2. Special Shapes: In addition to conventional cornerbead and control joints, provide U-bead at exposed panel edges.

F. Joint Materials: ASTM C 475 and as recommended by gypsum board manufacturer for project conditions.

1. Tape: 2 inch wide, coated glass fiber tape for joints and corners, except as otherwise indicated.

2. Ready-mixed vinyl-based joint compound.

G. High Build Drywall Surfacer: Vinyl acrylic latex-based coating for spray application, designed to take the place of skim coating and separate paint primer in achieving Level 5 finish.

H. Screws for Attachment to Steel Members From 0.033 to 0.112 inch in Thickness: ASTM C 954; steel drill screws for application of gypsum board to loadbearing steel studs.

I. 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

3.1 EXAMINATION

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

3.2 SHAFT WALL INSTALLATION

A. Shaft Wall Framing: Install in accordance with manufacturer's installation instructions.
   1. Fasten runners to structure with short leg to finished side, using appropriate power-driven fasteners at not more than 24 inches on center.
   2. Install studs at spacing required to meet performance requirements.

B. Shaft Wall Liner: Cut panels to accurate dimension and install sequentially between special friction studs.
   1. On walls over sixteen feet high, screw-attach studs to runners top and bottom.
   2. Seal perimeter of shaft wall and penetrations with acoustical sealant.

3.3 FRAMING INSTALLATION

A. Metal Framing: Install in accordance with ASTM C 754 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.
   3. Install bracing as required at exterior locations to resist wind uplift.
   4. Install isolation hangers in strict accordance with manufacturers written instructions.

C. Studs: Space studs as permitted by standard.
   1. Extend partition framing to structure where indicated and to ceiling in other locations.
   2. Partitions Terminating at Ceiling: Attach ceiling runner securely to to ceiling framing in accordance with details.
   3. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical devices in accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track.

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 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 partitions.
   5. Toilet accessories.
   6. Wall mounted door hardware.

3.4 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 Ceiling Isolation Hangers:
   1. The installation of all sound isolation materials shall be in accordance with procedures submitted by the isolation material manufacturer, and approved by the Architect.
   2. All building components supported by the isolation hangers shall be free from rigid contact with any part of the non-isolated building structure to prevent unwanted sound flanking.

C. Acoustic Sealant: Install in accordance with manufacturer's instructions.
   1. Place continuous bead at perimeter of each layer of gypsum board.
   2. In non-fire-rated construction, seal around all penetrations by conduit, pipe, ducts, and rough-in boxes.

3.5 BOARD INSTALLATION

A. Comply with ASTM C 840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

B. Single-Layer Non-Rated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.
   1. Exception: Tapered edges to receive joint treatment at right angles to framing.

C. Fire-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.

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 Metal Framing: Use screws for attachment of all gypsum board.

F. Curved Surfaces: Apply gypsum board to curved substrates in accordance with GA-226.

G. Moisture Protection: Treat cut edges and holes in moisture resistant gypsum board with sealant.

3.6 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
   1. Not more than 30 feet apart on walls and ceilings over 50 feet long.
   2. Install control joints at corners of all door and window frames up to top of gypsum board. Obtain Architect's approval of control joint locations prior to proceeding with installation.

B. Corner Beads: Install at external corners, using longest practical lengths.

C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials and as indicated.

3.7 JOINT TREATMENT

A. Finish gypsum board in accordance with levels defined in ASTM C 840, as follows:
1. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
2. Level 5: Walls and ceilings to receive semi-gloss or gloss paint finish and other areas specifically indicated.
3. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.
4. 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.
2. Taping, filling, and sanding is not required at surfaces behind adhesive applied ceramic tile and fixed cabinetry.

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.

3.8 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

END OF SECTION 09260

SECTION 09300 - TILE

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Tile for floor applications.

B. Tile for wall applications.

C. Tile for counters.

D. Cementitious backer board as tile substrate.

E. Stone thresholds.

F. Ceramic accessories.

G. Ceramic trim.

H. Non-ceramic trim.

1.2 RELATED REQUIREMENTS

A. Section 07130 - Sheet Waterproofing.

B. Section 07900 - Joint Sealers.

C. Section 09260 - Gypsum Board Assemblies: Installation of tile backer board.

1.3 REFERENCE STANDARDS

A. ANSI A108 Series/A118 Series/A136.1 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium); 2009.

B. ANSI A108.1a - American National Standard Specifications for Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar; 2005.

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 (R2005).

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 (R2005).

E. ANSI A108.4 - American National Standard Specifications for Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile-Setting Epoxy Adhesive; 1999 (R2005).

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 (R2005).

G. ANSI A108.6 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy; 1999 (R2005).

H. ANSI A108.8 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant Furan Resin Mortar and Grout; 1999 (R2005).

I. ANSI A108.9 - American National Standard Specifications for Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout; 1999 (R2005).

END OF SECTION 09300

SECTION 09511 - SUSPENDED ACOUSTICAL CEILINGS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Suspended metal grid ceiling system.

B. Acoustical units.

1.2 RELATED REQUIREMENTS

A. Section 01616 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 07212 - Board and Batt Insulation: Acoustical insulation.

C. Section 07900 - Joint Sealers: Acoustical sealant.

1.3 REFERENCE STANDARDS

A. ASTM C 635 - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2009b.

B. ASTM C 636/C 636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels; 2008.

C. ASTM E 580/E 580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2009a.

D. ASTM E 1264 - Standard Classification for Acoustical Ceiling Products; 2008.

1.4 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on suspension system components.

C. Samples: Submit two sample 6" x 6" in size illustrating material and finish of acoustical units.

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 01600 - Product Requirements, for additional provisions.
   2. Extra Acoustical Units: Quantity equal to 5 percent of total installed.

F. LEED Submittal: Documentation of recycled content and location of manufacture.

1.5 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.

1.6 FIELD CONDITIONS

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

PART 2 - PRODUCTS

2.1 ACOUSTICAL UNITS

A. Manufacturers:
1. Armstrong World Industries, Inc; Product: www.armstrong.com.
2. Hunter Douglas Contract; Product: www.hunterdouglascontract.com.
3. USG; Product: www.usg.com.
4. Substitutions: See Section 01600 - Product Requirements.

B. Acoustical Units - General: ASTM E1264, Class A.

C. Acoustical Tile Type ACT-1: Fiberglass, with to the following characteristics:
1. Surface Texture: Fine
2. Composition: Fiberglass
3. Color: White
4. Size: 24in X 24in X 3/4in
5. Edge Profile: Square Lay-In for interface with Prelude XL 15/16" Exposed Tee.
6. Noise Reduction Coefficient (NRC): ASTM C 423; Classified with UL label on product carton, 0.90.
7. Ceiling Attenuation Class (CAC): ASTM C 1414; Classified with UL label on product carton, Not Applicable
8. Articulation Class (AC): ASTM E 1111; Classified with UL label on product carton 180.
9. Emissions Testing: Section 01350 Protocol, < 13.5 ppb of formaldehyde when used under typical conditions required by ASHRAE Standard 62.1-2004, "Ventilation for Acceptable Indoor Air Quality"
10. Flame Spread: ASTM E 1264; Class A (UL)
11. Light Reflectance (LR): ASTM E 1477; White Panel: Light Reflectance: 0.90.
12. Dimensional Stability: HumiGuard Plus - Temperature is between 32°F (0° C) and 120°F (49° C). It is not necessary for the area to be enclosed or for HVAC systems to be functioning. All wet work (plastering, concrete, etc) must be complete and dry.
13. Antimicrobial Protection: Inherent - Resists the growth of mold/mildew and bacterial growth.
14. Acceptable Product: Equal to Optima Open Plan, 3150 as manufactured by Armstrong World Industries.

D. Acoustical Tile Type ACT-2: Painted mineral fiber, with to the following characteristics:
1. Surface Texture: Fine
2. Composition: Mineral Fiber
3. Color: White
4. Size: 24in X 24in X 3/4in

5. Edge Profile: Square Lay-In for interface with Prelude XL 15/16" Exposed Tee.
6. Noise Reduction Coefficient (NRC): ASTM C 423; Classified with UL label on product carton, 0.70.
7. Ceiling Attenuation Class (CAC): ASTM C 1414; Classified with UL label on product carton, 35
8. Emissions Testing: Section 01350 Protocol, < 13.5 ppb of formaldehyde when used under typical conditions required by ASHRAE Standard 62.1-2004, "Ventilation for Acceptable Indoor Air Quality"
9. Flame Spread: ASTM E 1264; Class A (UL)
10. Light Reflectance (LR): ASTM E 1477; White Panel: Light Reflectance: 0.86.
11. Dimensional Stability: HumiGuard Plus - Temperature is between 32°F (0° C) and 120°F (49° C). It is not necessary for the area to be enclosed or for HVAC systems to be functioning. All wet work (plastering, concrete, etc) must be complete and dry.
12. Antimicrobial Protection:
13. Acceptable Product: Equal to Health Zone Ultima, 1935 as manufactured by Armstrong World Industries.

E. Acoustical Tile Type ACT-3: Metal, with to the following characteristics:

F. Surface Texture: Fine
1. Composition: Electrogalvanized Steel - .021 inches with post production powder coated paint finish
2. Color: White
3. Size: 24in X 24in
4. Edge Profile: Square Lay-In for interface with Prelude XL 15/16" Exposed Tee
5. Noise Reduction Coefficient (NRC): ASTM C 423; Classified with UL label on product carton, 0.70.
6. Ceiling Attenuation Class (CAC): ASTM C 1414; Classified with UL label on product carton, 35.
7. Articulation Class (AC): ASTM E 1111; Classified with UL label on product carton .
8. Flame Spread: ASTM E 1264; Class A (UL)
9. Light Reflectance (LR): ASTM E 1477; White Panel: Light Reflectance: 0.86.
10. Dimensional Stability: HumiGuard Plus .
11. Mold/Mildew Inhibitor: The front and back of the product have been treated with BioBlock, a paint that contains a special biocide that inhibits or retards the growth of mold or mildew, ASTM D 3273.
12. Acceptable Product: Equal MetalWorks Vector and Vector Exterior, 6466M1, as manufactured by Armstrong World Industries.
13. Accessories: MetalWorks Vector Infill Panel (fiberglass infill) #820-01-00.

2.2 SUSPENSION SYSTEM(S)

A. Manufacturers:
1. Same as for acoustical units.
2. Substitutions: See Section 01600 - Product Requirements.

B. Suspension Systems - General: ASTM C 635; die cut and interlocking components, with stabilizer bars, clips, splices, perimeter moldings, and hold down clips as required.

C. Exposed Steel Suspension System: Formed steel, commercial quality cold rolled; intermediate-duty.

1. Components: All main beams and cross tees shall be commercial quality hot-dipped galvanized (galvanized steel, aluminum, or stainless steel) as per ASTM A 653. Main beams and cross tees are double-web steel construction with 15/16 IN type exposed flange design. Exposed surfaces chemically cleansed, capping pre-finished galvanized steel (aluminum or stainless steel) in baked polyester paint. Main beams and cross tees shall have rotary stitching (exception: extruded aluminum or stainless steel).

a. Structural Classification: ASTM C 635 HD.

b. Color: White and match the actual color of the selected ceiling tile, unless noted otherwise. Use black at metal ceilings.

c. Acceptable Product: Equal to Prelude XL 15/16" Exposed Tee as manufactured by Armstrong World Industries, Inc.

2. Attachment Devices: Size for five times design load indicated in ASTM C 635, Table 1, Direct Hung unless otherwise indicated.

3. Wire for Hangers and Ties: ASTM A 641, Class 1 zinc coating, soft temper, pre-stretched, with a yield stress load of at least time three design load, but not less than 12 gauge.

4. Edge Moldings and Trim: Metal or extruded aluminum of types and profiles indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations, including light fixtures, that fit type of edge detail and suspension system indicated. Provide moldings with exposed flange of the same width as exposed runner.

5. Finish: White painted.

2.3 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.

2. At Concealed Grid: Provide exposed L-shaped molding.

C. Acoustical Insulation: Specified in Section 07212.

D. Acoustical Sealant For Perimeter Moldings: Specified in Section 07900.

E. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that layout of hangers will not interfere with other work.

3.2 INSTALLATION - SUSPENSION SYSTEM

A. Install suspension system in accordance with ASTM C 636/C 636M, ASTM E 580/E 580M, 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. Lay out system to a balanced grid design with edge units no less than 50 percent of acoustical unit size.

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 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. Install in bed of acoustical sealant.
2. Use longest practical lengths.
3. Overlap and rivet corners.

3.3 INSTALLATION - ACOUSTICAL UNITS

A. Install acoustical units in accordance with manufacturer's instructions.

B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.

C. Fit border trim neatly against abutting surfaces.

D. Install units after above-ceiling work is complete.

E. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.

F. Cutting Acoustical Units:

1. Make field cut edges of same profile as factory edges.

G. Where round obstructions occur, provide preformed closures to match perimeter molding.

H. Install hold-down clips on panels within 20 ft of an exterior door.

3.4 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.

B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

END OF SECTION 09511

SECTION 09546 - LINEAR METAL CEILINGS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Linear, formed metal perforated soffit panels with curved suspended support framing.

1.2 RELATED REQUIREMENTS

A. Section 07212 - Board and Batt Insulation.

1.3 REFERENCE STANDARDS

A. ASTM B 209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2007.

B. ASTM B 209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric]; 2007.

C. ASTM C 636/C 636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2006.

1.4 PERFORMANCE REQUIREMENTS

A. Installed Soffit System:
   1. Support imposed loads of indicated items without eccentric loading of supports.
   2. Exhibit maximum deflection of 1/360 of span.
   3. Resist seismic load required by applicable code.

B. Exterior Soffit and Suspension System: Accommodate wind and suction loads and wind uplift without damage in accordance with applicable code.

1.5 SUBMITTALS

A. Product Data: Furnish for component profiles.

B. Shop Drawings: Indicate reflected plan.

C. Samples: Submit two samples 12 x 12 inch in size illustrating color and finish of exposed to view components.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum three years' experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Accept factory-finished products on site in manufacturer's unopened factory packaging only; reject opened packages.

B. Protect factory-finished products from damage to appearance by storing products in manufacturer's unopened factory packaging in dry storage area.

1.8 WARRANTY

A. Provide five year manufacturer warranty; include coverage for corrosion resistance and discoloration of surface finish.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Linear Metal Ceilings:

1. Hunter Douglas Contract: www.hunterdouglascontract.com.

2. Chicago Metallic Corporation: www.chicagometallic.com.

3. USG: www.usg.com.

4. Simplex Ceilings: www.simplex.com.

2.2 COMPONENTS

A. Linear Panels:

1. Model No: Equal to PlanarPlus linear metal ceiling systems as manufactured by Chicago Metallic, 4849 South Austin Avenue, Chicago, Illinois 60638. 1-800-323-7164.

2. Size: 4" wide pan dimension x 3/4" deep.

3. Style: Perforated with pattern equal to PlanarPlus #62R2185.

4. Material: Aluminum sheet, perforated, ASTM B 209, 0.018 inch thickness.

5. Edge: Round egdes with integral filler strips.

6. Sight-exposed Surface Finish: Anodized finish; color selected from manufacturer's standard range.

B. Edge Molding, and Splices: Same material, thickness, and finish as linear panels.

C. Symmetrical Carrier:

1. Manufactured to an inverted "U" shape from 0.040 inch aluminum 144 inches long. Coat with black polyester enamel. Provide double grip carrier required on all exterior applications.

2. Slotted at appropriate intervals to receive stabilizing components as described below.

D. Stabilizer Bars: Manufactured from 0.025 inch thick aluminum (4913/16) (3513/16) inch long. Coat with black polyester enamel.

E. Radius Carrier: Manufactured to an inverted "U" shape from 0.040 inch thick aluminum 120 inches long with integral carrier tabs, painted black.

F. Suspension Members: Formed steel sections, with integral attachment points; primed finish; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.

G. Suspension Wire: Steel, annealed, plain finish, 12 gage diameter.

2.3 FABRICATION

A. Shop cut linear panels to accommodate mechanical and electrical items.

B. Factory-form internal and external corners of same material, thickness, finish, and profile to match exposed linear panels; back brace internal corners.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that layout of hangers will not interfere with other work.

C. Verify that field measurements are as indicated.

3.2 INSTALLATION

A. Suspension Components:
1. Install after above-ceiling work is complete in accordance with manufacturer's instructions and ASTM C 636/C 636M.
2. Hang carrying members independent of walls, columns, ducts, light fixtures, pipe, and conduit; where carrying members are spliced, avoid visible displacement of face panels with adjacent panels.
3. Where ducts or other equipment prevent regular spacing of hangers, reinforce nearest adjacent hangers to span the required distance.
4. Suspension System
   a. Symmetrical Carriers: Installed 50 inches on center by direct suspension from existing structure with not less than 12 gauge hanger wires wrapped tightly 3 full turns, spaced 48 inches on center.
   b. Stabilizer Bars: Installed perpendicular to symmetrical carrier 48 inches on center.

B. Linear Panels:
1. Install linear panels and other system components in accordance with manufacturer's instructions.
2. Linear Metal Panels:
a. Attach to main carrier tabs and connect with Panel Splices with joints staggered in adjacent rows.
3. Slip-on Moldings: Install on exposed ends of panels.
4. End Plugs: Installed exposed ends of panels.
5. Wall Angles: Installed on vertical surfaces intersecting system by appropriate method in accordance with industry accepted practice.
6. Access Panels: Installed in accordance with manufacturers recommendations.
7. Stagger end joints minimum 12 inches.
8. Set exterior end joints with 1/16 inch gap for expansion and contraction.
9. Exercise care when site cutting sight-exposed finished components to ensure surface finish is not defaced.

3.3 CLEANING

A. Clean polished surfaces.

B. Replace damaged or abraded components.

END OF SECTION 09546

SECTION 09625 - RESILIENT ATHLETIC FLOORING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Rubber tile flooring, adhesively installed.

B. Accessories.

1.2 RELATED REQUIREMENTS

A. Section 01616 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 03300 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors.

1.3 REFERENCE STANDARDS

A. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2006a.

B. ASTM D 2240 - Standard Test Method for Rubber Property--Durometer Hardness; 2005.

1.4 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's printed data sheets for products specified.

C. Shop Drawings: Fabrication and installation details, and layout, colors, and widths of game lines and equipment locations.

D. LEED Submittal: Documentation of recycled content and location of manufacture.

E. Selection Samples: Manufacturer's color charts for flooring materials specified, indicating full range of colors and textures available.

F. Verification Samples: Actual flooring material specified, not less than 12 in square, mounted on solid backing.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer certified in writing by the flooring manufacturer to be qualified for installation of specified flooring system.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to project site in unopened containers clearly labeled with manufacturer's name and identification of contents.

B. Store materials in dry and clean location until needed for installation. During installation, handle in a manner that will prevent marring and soiling of finished surfaces.

C. All flooring materials are to be delivered to the job site 72 hours prior to installation and are to be stored where they are to be installed. Roll goods are to be stored on end. Roll goods must be unrolled 24 hours prior to installation. A temperature level of 65°-75° F and relative humidity level of 45° - 65° must be maintained 72 hours prior to, during and 72 hours after installation.

1.7 WARRANTY

A. Manufacturer shall provide a five (5) year warranty against manufacturing defects.

PART 2 - PRODUCTS

2.1 PREFORMED ATHLETIC FLOORING

A. Manufacturers: All products by the same manufacturer.
1. Expanko Company, Inc:www.expanko.com.
2. Pawling Corporation: www.pawling.com.
3. Robbins Sports Surfaces: www.robbinsfloor.com. Substitutions: See Section 01600 - Product Requirements.

B. Rubber Tile Flooring: Rubber tile goods comprising rubber granules from recycled automobile tires, post-industrial waste rubber and virgin rubber ganules encapsulated in a zero- mercury polyurethane binder, lengths to minimize transverse seams.
1. Flooring shall be made of minimum 5% SBR and maximum 95% EPDM rubber with a non-yellowing urethane binder. Material shall be colored throughout the tile with fade resistant pigments. Material shall be rated for flammability as class I (ASTM E648) if 70% or greater EPDM material is specified. Material shall be rated for flammability as class II for materials specified with less than 70% EPDM.
2. Thickness: Minimum 0.32 in or 8 mm.
3. Tile Size: Minimum 36 inches x 36 inches.
4. Density: Shall exceed 78 lb/ft3.
5. Color: As scheduled.
6. Basis of Design: Reztek as manufactured by Expanko.

2.2 ACCESSORIES

A. Leveling Compound: Latex-modified cement formulation as recommended by flooring manufacturer for substrate conditions.

B. Adhesive: Water-resistant type recommended by flooring manufacturer for project conditions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates for conditions detrimental to installation of athletic flooring. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of athletic flooring to substrate.

C. Cementitious Sub-floor Surfaces: Verify that substrates are dry enough and ready for resilient flooring installation by testing for moisture and pH.

3.2 PREPARATION

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

B. Concrete: Use leveling compound as necessary to achieve substrate flatness of plus or minus 1/8 inch within 10 ft radius.

C. Remove coatings that are incompatible with flooring adhesives, using methods recommended by flooring manufacturer.

D. Broom clean areas to receive athletic flooring immediately before beginning installation.

3.3 INSTALLATION

A. Starting installation constitutes acceptance of sub-floor conditions.

B. Comply with manufacturer's recommendations and approved shop drawings.

C. Rubber Tile Flooring:

1. Lay out center lines in spaces to receive tile flooring, based on location of principal walls. Start tile installation from center, and adjust as necessary to avoid tiles less than one-half width at perimeter.
2. Mix adhesive thoroughly and apply to substrate with notched trowel. Roll flooring into fresh adhesive, overlapping end seams and double cutting, butting factory edges and compression fitting.
3. Lay tiles square with room axis, matching for color and pattern by selecting from cartons and mixing as recommended by manufacturer.

3.4 CLEANING

A. Clean flooring using methods recommended by manufacturer.

3.5 PROTECTION

A. Protect finished athletic flooring from construction traffic to ensure that it is without damage upon completion of the work.

END OF SECTION 09625

SECTION 09650 - RESILIENT FLOORING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Resilient tile flooring.

B. Resilient base.

C. Resilient stair accessories.

D. Installation accessories.

1.2 RELATED REQUIREMENTS

A. Section 01616 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 03300 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors.

C. Section 16000: Electrical floor cover plates for installation of resilient flooring specified in this section.

1.3 REFERENCE STANDARDS

A. ASTM E 648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2009a.

B. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2008.

C. ASTM F1861 - Standard Specification for Resilient Wall Base; 2008.

D. ASTM F2195 - Standard Specification for Linoleum Floor Tile; 2007.

E. BAAQMD 8-51 - Bay Area Air Quality Management District Regulation 8, Rule 51, Adhesive and Sealant Products; www.baaqmd.gov; 2002.

F. FS RR-T-650 - Treads, Metallic and Nonmetallic, Skid Resistant; Federal Specifications and Standards; Revision E, 1994.

G. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; National Fire Protection Association; 2011.

H. SCAQMD 1168 - South Coast Air Quality Management District Rule No.1168; current edition; www.aqmd.gov.

1.4 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.

C. Shop Drawings: Indicate seaming plan.

D. Selection Samples: Submit manufacturer's complete set of color samples for Architect's initial selection.

E. Verification Samples: Submit two samples, 6 x 6 inch in size illustrating color and pattern for each resilient flooring product specified.

F. Certification: Prior to installation of flooring, submit written certification by flooring manufacturer and adhesive manufacturer that condition of sub-floor is acceptable.

G. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

H. LEED Report: Report recycled content and VOC emission of flooring; VOC content of adhesives.
   1. For linoleum flooring, report rapidly-renewable content and urea-formaldehyde content.

I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01600 - Product Requirements, for additional provisions.
   2. Extra Flooring Material: 50 square feet of each type and color.

J. LEED Submittal: Documentation of recycled content and location of manufacture.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect roll materials from damage by storing on end.

1.6 FIELD CONDITIONS

A. Maintain temperature in storage area between 55 degrees F and 90 degrees F.

B. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.

PART 2 - PRODUCTS

2.1 SHEET FLOORING

A. Linoleum: Homogeneous wear layer bonded to backing, with color and pattern through wear layer thickness:

1. Minimum Requirements: Comply with ASTM F 2195, Type corresponding to type specified.
2. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E 648 or NFPA 253.
3. VOC Content: As specified in Section 01616.
4. Backing: Synthetic fabric.
5. Wear Layer Thickness: 0.098 inch, minimum, excluding backing.
6. Size: 72" wide, unless otherwise shown on Drawings.
7. Pattern: See Drawings.
8. Color: See Drawings, several colors required.
9. Manufacturers:
   a. Forbo Linoleum, Inc: www.forbo-industries.com.
   b. Tarkett Inc: www.tarkett.com. Substitutions: See Section 01600 - Product Requirements.

B. Feature Strips: Of same material as tile, size as shown on Drawings.

C. Flash Cove Trim: Provide flash cove moulding at floor/wall joint with clear anodized J-mould cap.

2.2 STAIR COVERING

A. Stair Treads: Rubber; full width and depth of stair tread in one piece; tapered thickness; nosing not less than 1-5/8 inch deep.

1. Minimum Requirements: Comply with FS RR-T-650 requirements corresponding to type specified.
2. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E 648 or NFPA 253.
3. Nominal Thickness: 0.1875 inch.
4. Nosing: Square.
5. Style: Contrasting color abrasive grit strips full width.
6. Color: Johnsonite #29 Moon Rock.
7. Manufacturers:
   a. Burke Flooring: www.burkemercer.com.
   b. Johnsonite, Inc: www.johnsonite.com.
   c. Roppe Corp: www.roppe.com.
   d. Substitutions: See Section 01600 - Product Requirements.

B. Stair Stringers: Full height in one piece and in maximum available lengths, matching treads in material and color:

1. Thickness: 0.080 inch.
2. Pattern: Solid color.

2.3 RESILIENT BASE

A. Resilient Base: ASTM F 1861, Type TS rubber, vulcanized thermoset; top set Style B, Cove, and as follows:

1. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E 648 or NFPA 253.
2. Height: 4 inch.
3. Thickness: 0.125 inch thick.
4. Finish: Satin.
5. Length: 4 foot sections.
6. Color: Color as selected from manufacturer's standards.
7. Accessories: Premolded external corners and end stops.
8. Manufacturers:
   a. Burke Flooring: www.burkemercer.com.
   b. Johnsonite, Inc: www.johnsonite.com.
   c. Roppe Corp: www.roppe.com.
   d. Substitutions: See Section 01600 - Product Requirements.

2.4 ACCESSORIES

A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.

B. Primers, Adhesives, and Seaming Materials: Waterproof; types recommended by flooring manufacturer.

1. Provide only products having lower volatile organic compound (VOC) content than required by the more stringent of the South Coast Air Quality Management District Rule No.1168 and the Bay Area Air Quality Management District Regulation 8, Rule 51.

C. Moldings, Transition and Edge Strips: Same material as flooring.

D. Filler for Coved Base: Plastic.

E. Sealer and Wax: Types recommended by flooring manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.

C. Verify that concrete sub-floor surfaces are dry enough and ready for resilient flooring installation by testing for moisture emission rate and alkalinity in accordance with ASTM F 710; obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.

3.2 PREPARATION

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

B. Remove sub-floor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with sub-floor filler to achieve smooth, flat, hard surface.

C. Prohibit traffic until filler is cured.

D. Clean substrate.

3.3 INSTALLATION

A. Starting installation constitutes acceptance of sub-floor conditions.

B. Install in accordance with manufacturer's instructions.

C. Spread only enough adhesive to permit installation of materials before initial set.

D. Fit joints tightly.

E. Set flooring in place, press with heavy roller to attain full adhesion.

F. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.

G. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.

H. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

I. Install flooring in recessed floor access covers, maintaining floor pattern.

J. Install feature strips where indicated.

3.4 SHEET FLOORING

A. Lay flooring with joints and seams parallel to longer room dimensions, to produce minimum number of seams. Lay out seams to avoid widths less than 1/3 of roll width; match patterns carefully at seams.

B. Double cut sheet at seams.

C. Lay flooring with tightly butted seams, without any seam sealer.

3.5 TILE FLOORING

A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless manufacturer's instructions say otherwise.

B. Lay flooring with joints and seams parallel to building lines to produce symmetrical tile pattern.

3.6 RESILIENT BASE

A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.

B. Miter internal corners. At external corners, use premolded units. At exposed ends, use premolded units.

C. Install base on solid backing. Bond tightly to wall and floor surfaces.

3.7 STAIR COVERINGS

A. Install stair coverings in one piece for full width and depth of tread.

B. Install stringers configured tightly to stair profile.

C. Adhere over entire surface. Fit accurately and securely.

3.8 CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damage.

B. Clean in accordance with manufacturer's instructions.

3.9 PROTECTION

A. Prohibit traffic on resilient flooring for 48 hours after installation.

END OF SECTION 09650

SECTION 09685 - CARPET TILE

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Carpet tile, fully adhered.

1.2 RELATED REQUIREMENTS

A. Section 01616 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 01732 - Waste Management: Reclamation/Recycling of new carpet tile scrap.

C. Section 03300 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors.

1.3 REFERENCE STANDARDS

A. ASTM D 2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials; 2006.

B. ASTM E 648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2009a.

C. ASTM F 710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2008.

D. CRI (CIS) - Carpet Installation Standard; Carpet and Rug Institute; 2009.

E. CRI (GLA) - Green Label Testing Program - Approved Adhesive Products; Carpet and Rug Institute; Current Edition.

F. CRI (GLP) - Green Label Plus Carpet Testing Program - Approved Products; Carpet and Rug Institute; Current Edition.

1.4 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate layout of joints.

C. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.

D. Samples: Submit two carpet tiles illustrating color and pattern design for each carpet color selected.

E. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 01600 - Product Requirements, for additional provisions.
2. Extra Carpet Tiles: Quantity equal to 5 percent of total installed of each color and pattern installed.

1.5 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 with minimum three years' experience.

1.6 WARRANTY

A. Provide manufacturer's standard ten (10) year wear warranty.

1.7 FIELD CONDITIONS

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Other Acceptable Manufacturers:
1. Interface, Inc: www.interfaceinc.com.
2. Lees Carpets: www.leescarpets.com.
3. Milliken & Company: www.milliken.com.
4. Shaw Industries, Inc. (Added by Addendum No. 1).
5. Substitutions: See Section 01600 - Product Requirements.

2.2 MATERIALS

A. Carpet Tile:
1. CPT-1: Modular carpet tile equal to Interface, Super Flor, 609009, MouseGray.
2. CPT-2: Modular carpet tile equal to Interface, Flor, 603059, Anthracite.
3. CPT-3: Modular carpet tile equal to Interface Flor, 603192, Berber Beige.
4. CPT-4: Modular carpet tile equal to Interface Super Flor, 609162, Primavera.
5. CPT51: Modular carpet tile equal to J&J/Invision, Mosaic Modular, 480 Foil.
6. CPT-1: Broadloom carpet equal to J&J/Invision, Huetopia, 3043 Brilliant Blueberry.

2.3 ACCESSORIES

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

B. Edge Strips: Embossed aluminum, scheduled color.

C. Adhesives: Acceptable to carpet tile manufacturer, compatible with materials being adhered; maximum VOC of 50 g/L; CRI Green Label certified; in lieu of labeled product, independent test report showing compliance is acceptable.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that sub-floor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive carpet tile.

C. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to sub-floor surfaces.

D. Verify that concrete sub-floor surfaces are dry enough and ready for flooring installation by testing for moisture emission rate and alkalinity in accordance with ASTM F 710; obtain instructions if test results are not within limits recommended by carpet tile manufacturer and adhesive materials manufacturer.

3.2 PREPARATION

A. Remove sub-floor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with sub-floor filler.

B. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.

C. Vacuum clean substrate.

3.3 INSTALLATION

A. Starting installation constitutes acceptance of sub-floor conditions.

B. Install carpet tile in accordance with manufacturer's instructions and CRI Carpet Installation Standard.

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.

3.4 CLEANING

A. Remove excess adhesive without damage, from floor, base, and wall surfaces.

B. Clean and vacuum carpet surfaces.

END OF SECTION 09685

SECTION 09720 - WALL COVERING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Surface preparation and prime painting.

B. Wall covering and borders.

1.2 RELATED REQUIREMENTS

A. Section 01616 - Volatile Organic Compound (VOC) Content Restrictions.

1.3 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2010b.

1.4 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on wall covering and adhesive.

C. Samples: Submit two samples of wall covering, 6 x 6 inch 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. LEED Submittal: Documentation of recycled content and location of manufacture.

1.5 QUALITY ASSURANCE

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

1.6 DELIVERY, STORAGE, AND HANDLING

A. Inspect roll materials at arrival on site, to verify acceptability.

B. Protect packaged adhesive from temperature cycling and cold temperatures.

C. Do not store roll goods on end.

1.7 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.

PART 2 - PRODUCTS

2.1 BASE BID MANUFACTURER

A. Designtex ®, A Steelcase Company.

B. Other Acceptable Manufacturers:
1. Omnova Solutions Inc: www.omnova.com.
2. Koroseal/RJF International: www.koroseal.com.
3. MDC Wallcoverings: www.mdcwall.com.
4. Substitutions: See Section 01600 - Product Requirements.

2.2 MATERIALS

A. Requirements for All Wall Coverings:
1. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84.

B. Wall Covering: conforming to the following:

1.	STYLE:	Designtex "WIPE OUT"
2.	STYLE NUMBER:	J277
3.	CONTENTS:	100% Vinyl
4.	WEIGHT:	30.00 oz./lin.yd.
5.	WIDTH:	60”
6.	FINISH:	none
7.	BACKING:	non-woven wall covering
8.	REPEAT:	Approx Horiz/Vert: 0.00”/0.00"
9.	COLORS:	White
10.	FLAMMABILITY TESTING:	Class A Rating** Test method- ASTM E84 (Adhered Mounting) *, NFPA #255, UBC #42-1, ANSI #2.5, U.L. #723.
11.	COLORFASTNESS:	Light Class 4, minimum @40 hrs** Test Method - AATCC 16 A or E Dry Crocking - Class 3 minimum** Test Method - AATCC 8 Wet Crocking - Class 3 minimum** Test Method AATCC 8

C. Substrate Primer and Sealer: Alkyd enamel type.

PART 3 - EXECUTION

3.1 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 nor vary at a rate greater than 1/16 inch/ft.

3.2 PREPARATION

A. Wash impervious surfaces with tetra-sodium phosphate, rinse and neutralize; wipe dry.

B. Surface Appurtenances: Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.

C. Surfaces: Correct defects and clean surfaces that affect work of this section. Remove existing coatings that exhibit loose surface defects.

D. Apply one coat of primer sealer to substrate surfaces. Allow to dry. Lightly sand smooth.

E. Vacuum clean surfaces free of loose particles.

3.3 INSTALLATION

A. Apply adhesive and wall covering in accordance with manufacturer's instructions.

B. Apply adhesive to wall surface immediately prior to application of wall covering. Let contact adhesive set tack free.

C. Razor trim edges on flat work table. Do not razor cut on gypsum board surfaces.

D. Do not seam within 2 inches of internal corners or within 6 inches of external corners.

E. Install wall covering before installation of bases and items attached to or spaced slightly from wall surface.

F. Do not install wall covering more than 1/4 inch below top of resilient base.

G. Cover spaces above and below windows, above doors, in pattern sequence from roll.

H. Where wall covering tucks into reveals, or metal wallboard or plaster stops, apply with contact adhesive within 6 inches of wall covering termination. Ensure full contact bond.

I. Remove excess adhesive while wet from seam before proceeding to next wall covering sheet. Wipe clean with dry cloth.

3.4 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.

3.5 PROTECTION

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

END OF SECTION 09720

SECTION 09770 - FIBERGLASS REINFORCED PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 ENVIRONMENTAL CONDITIONS

A. Building should be fully enclosed prior to installation with sufficient heat (70°F) and ventilation consistent with good working conditions for finish work.

1.3 DELIVERY AND STORAGE

A. Materials are to be factory packaged on strong pallets. All materials are to be stored lying flat, under cover and protected from the elements. Panels should be allowed to acclimate to room temperature (70°) for 48 hours prior to installation.

1.4 WARRANTY

A. All products shall be warranted to be free from defects for a period of one (1) year after Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products equal to the following:
   1. Marlite, 202 Harger Street, Dover, OH, 44622, Ph # 1(330)343-6621.
   2. Crane Composites Inc., Ph # 1(800)435-0080. 3. FRP Shop, Ph # 1(800)749-1431.

2.2 MATERIALS

A. Materials: All FRP wall panels shall be equal to Marlite® Brand Symmetrix, with Sani-Coat sealer.

B. Size: Panel Size: 48" x 96" x 3/32".

C. Scoring Patterns: 4" x 4".

2.3 ACCESSORIES

A. All trim specified shall be extruded rigid PVC.
   1. Trim Finish: Factory finish colors to coordinate with FRP panels.

      a. Extruded PVC to be color-thru.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Open cartons and carefully inspect all panels.

3.2 PREPARATION

A. Panels must be applied over a smooth, solid, flat, clean substrate such as drywall or plywood.

3.3 CONDITIONING

A. Panels should be opened and allowed to acclimate for 48 hours prior to installation. Room temperature should be approximately 70° F.

3.4 INSTALLATION

A. Install all panels in strict accordance with manufacturer's installation instructions.

B. All moldings must provide for a minimum 1/8 inch expansion joint to insure proper installation.

C. FRP Adhesive: Water-resistant, non-flammable adhesive, C-551 meets ASTM Specification C557.

D. Construction Adhesive: Strong, flexible, water-resistant, solvent based adhesive formulated for fast, easy application, C-375 meets ASTM Specification C557.

E. SEALANT

F. Color Match Sealant: Colors to coordinate with FRP panels.

3.5 MAINTENANCE

A. Refer to manufacturer's specific cleaning recommendations. Do not use abrasive cleaners.

END OF SECTION 09770

SECTION 09900 - PAINTS AND COATINGS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints, stains, varnishes, and other coatings.

C. Scope: Finish all interior and exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:

D. Do Not Paint or Finish the Following Items:
1. Items fully factory-finished unless specifically so indicated; materials and products having factory-applied primers are not considered factory finished.
2. Items indicated to receive other finishes.
3. Items indicated to remain unfinished.
4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
5. Floors, unless specifically so indicated.
6. Glass.
7. Concealed pipes, ducts, and conduits.

1.2 RELATED REQUIREMENTS

A. Section 01616 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 05500 - Metal Fabrications: Shop-primed items.

C. Section 05510 - Metal Stairs: Shop-primed items.

D. Section 09260 - Gypsum Board Assemblies.

E. Section 09960 - High-Performance Coatings.

1.3 DEFINITIONS

A. Conform to ASTM D 16 for interpretation of terms used in this section.

1.4 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 D 16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2008.

C. ASTM D 4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials; 2007.

D. GreenSeal GS-11 - Paints; 1993.

E. SSPC (PM1) - Good Painting Practice: SSPC Painting Manual, Vol. 1; Society for Protective Coatings; Fourth Edition.

F. USGBC LEED-NC - LEED Green Building Rating System for New Construction and Major Renovations; U.S. Green Building Council; 2009.

1.5 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on all finishing products, including VOC content.

C. Samples: Submit two paper chip samples, 6 inch x 6 inch in size illustrating range of colors and textures available for each surface finishing product scheduled.

D. Certification: By manufacturer that all paints and coatings comply with VOC limits specified.

E. Certification: By manufacturer that all paints and coatings do not contain any of the prohibited chemicals specified; GreenSeal GS-11 certification is not required but if provided shall constitute acceptable certification.

F. Manufacturer's Instructions: Indicate special surface preparation procedures.

G. Maintenance Data: Submit data on cleaning, touch-up, and repair of painted and coated surfaces.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01600 - Product Requirements, for additional provisions.
   2. Extra Paint and Coatings: 1 gallon of each color; store where directed.
   3. Label each container with color in addition to the manufacturer's label.

1.6 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.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.8 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. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

D. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Provide all paint and coating products used in any individual system from the same manufacturer; no exceptions.

B. Paints:
1. Glidden Professional: www.gliddenprofessional.com.
2. Benjamin Moore & Co: www.benjaminmoore.com.
3. PPG Architectural Finishes, Inc: www.ppgaf.com.

C. Substitutions: See Section 01600 - Product Requirements.

2.2 PAINTS AND COATINGS - GENERAL

A. Paints and Coatings: Ready mixed, unless intended to be a field-catalyzed coating.
1. Provide paints and coatings of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
3. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
4. Supply each coating material in quantity required to complete entire project's work from a single production run.
5. Do not reduce, thin, or dilute coatings or add materials to coatings unless such procedure is specifically described in manufacturer's product instructions.

B. Primers: Where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer.

C. Volatile Organic Compound (VOC) Content: Comply with Section 01616.

D. Colors: As indicated on drawings

2.3 MATERIALS

A. General: See Painting Schedules in Part 3 - EXECUTION for paint products.
1. Material Compatibility: Provide block fillers, primers, undercoats, and finish coat materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
2. Material Quality: Provide manufacturer's best quality paint material of the various coating types specified. Paint material containers not displaying manufacturer's product identification will not be acceptable.
a. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.
1) Colors: Match colors indicated by reference to manufacturer's color designation.

B. Writable/Erasable Paint:
1. A two-component, water-based, clear, dry erase paint that offers the flexibility of a writable/erasable wall surface. Provides a high performance writing surface that can be used with a standard dry erase marker and dry erase eraser.
2. Basis of Design: Equal to WriteUp h2o as manufactured by DesignTex, a Steelcase Company.
a. Cure time: for use 7 days, full cure 30 days.
b. Markers: standard dry erase marker.
c. Eraser: standard foam dry erase eraser.
d. Ventilation: no special requirements necessary.
e. Pot life: 3 hours.
f. Shelf life: 2 years not mixed and properly stored.
g. Flammability: ASTM E84 Class A.
h. VOC: 44 g/l - meets LEED IEQ 4.2 VOC limits.
i. Cleaning: (for installer only) water and mild detergent prior to cure / simple solvent after.
j. Cure (during use) water moistened soft cloth.
k. Color: can be applied over any properly prepared surface with unlimited base color options.
l. Accessories: marker and eraser kit.
m. Warranty: 10 year limited warranty.

C. Pavement Marking Paint: Provide alkyd resin type, factory-mixed, pavement marking paint, type and color as indicated below, and complying with AASHTO M248.
1. Type: Type S.
2. Color: As indicated on the Drawings.
3. Product: Subject to compliance with requirements, provide one of the following products:
a. “Traffic Zone Paint”, Glidden Co.
b. “Traffic and Zone Marking Paint”, PPG Architectural Finishes, Inc.
c. “Pro-Mar Traffic Marking Paint”, Sherwin-Williams Co.

2.4 ACCESSORY MATERIALS

A. Accessory Materials: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required to achieve the finishes specified whether specifically indicated or not; commercial quality.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

C. Test shop-applied primer for compatibility with subsequent covermaterials.

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. Plaster and Stucco: 12 percent.
3. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.
4. Interior Wood: 15 percent, measured in accordance with ASTM D 4442.
5. Concrete Floors and Traffic Surfaces: 8 percent.

3.2 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to coating application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.

D. Seal surfaces that might cause bleed through or staining of topcoat.

E. 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. Concrete and Unit Masonry Surfaces to be Painted: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.

G. Gypsum Board Surfaces to be Painted: Fill minor defects with filler compound. Spot prime defects after repair.

H. Plaster Surfaces to be Painted: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.

I. Concrete Floors and Traffic Surfaces to be Painted: Remove contamination, acid etch, and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.

J. Galvanized Surfaces to be Painted: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.

K. Corroded Steel and Iron Surfaces to be Painted: Prepare using at least SSPC-PC 2 (hand tool cleaning) or SSPC-SP 3 (power tool cleaning) followed by SSPC-SP 1 (solvent cleaning).

L. Uncorroded Uncoated Steel and Iron Surfaces to be Painted: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by hand or power tool wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Prime paint entire surface; spot prime after repairs.

M. Shop-Primed Steel Surfaces to be Finish Painted: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.

N. Interior Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.

O. Interior Wood Surfaces to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats. Prime concealed surfaces with gloss varnish reduced 25 percent with thinner.

P. Wood Doors to be Field-Finished: Seal wood door top and bottom edge surfaces with clear sealer.

3.3 APPLICATION

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

B. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

C. Apply each coat to uniform appearance.

D. Sand wood and metal surfaces lightly between coats to achieve required finish.

E. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

F. Wood to Receive Transparent Finishes: Tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.

G. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

H. Writable/Erasable Paint: Follow manufacturer's detailed written instructions.

3.4 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.5 PROTECTION

A. Protect finished coatings until completion of project.

B. Touch-up damaged coatings after Substantial Completion.

3.6 PAINTING SCHEDULES

A. Exterior Painting Schedule:
1. Ferrous Metal:
a. Surfaces to Receive High Performance Paint:
1) One coat of primer.
(a) Duron: “Dura Clad Rust Inhibitive Epoxy Primer 93-361.”
(b) ICI: “Devra Epoxy Double Build Primer 205.”
(c) Moore: “Polyamide Epoxy Metal Primer M33/M34.”
(d) PPG: “Pittsburgh Paints Epoxy Fast Dry Primer 94-109 Series.”
(e) Porter: “PorterGlaze Polyamide Epoxy Primer PC4300.”
(f) S-W: “Recoatable Epoxy Primer B67H5/B67V5.”
2) Two coats of acrylic aliphatic polyurethane.
(a) Duron: “Dura Clad High Solids Acrylic Aliphatic Urethane Gloss 93-3 Series.”
(b) ICI: “ICI 4708.”
(c) Moore: “Aliphatic Urethane Gloss M74.”
(d) PPG: “Pitthane 35 Acrylic Aliphatic Gloss Urethane Enamel 95-850 Series.”
(e) Porter: “PorterThane HS Aliphatic Urethane Gloss PC9100.”
(f) S-W: “Corothane II Polyurethane Gloss B65-400.”
b. Other Surfaces:
1) One coat of primer.
(a) Duron: “Dura Clad Alkyd White Metal Primer 30-010.”
(b) ICI: “ICI Universal Fast-Dry Metal Primer 4160.”
(c) Moore: “Universal Metal Primer M07.”
(d) PPG: “Multiprime Quick Dry Universal Primer 97-680 Series.”
(e) Porter: “PorterGuard Alkyd Metal Primer 272/276.”
(f) P&L: “Effecto Rust-Inhibiting Primer.”
(g) S-W: “Kem Kromik Universal Primer.”
2) Two coats of gloss enamel.
(a) Duron: “Dura Clad Alkyd Gloss Enamel (Urethane Modified) 12 Series.”
(b) ICI: “ICI Alkyd Industrial Enamel 4308.”
(c) Moore: “Urethane Alkyd Gloss M22.”
(d) PPG: “Pittsburgh Paints Interior/Exterior Industrial Gloss Oil 7-282 Series.”
(e) Porter: “PorterGuard Alkyd Gloss Enamel 2700 Series.”
(f) P&L: “Effecto Enamel.”
(g) S-W: “Industrial Enamel B54 Series.”

2. Galvanized Metal:
   a. One coat of primer.
      1) Duron: "Dura Clad Acrylic Galvanized Metal Primer White 33-100."
      2) ICI: "ICI All-Purpose Metal Primer 4120."
      3) Moore: "Acrylic Metal Primer M04."
      4) PPG: "Pitt-Tech Primer/Finish DTM Acrylic Enamel 90-708 Series."
      5) Porter: "PorterGuard DTM Acrylic Metal Primer 215."
      6) P&L: "Noxide Protective Coating Galvanized Metal Primer."
      7) S-W: "Galvite HS B50WZ30."
   b. Two coats of gloss enamel.
      1) Duron: "Dura Clad Alkyd Gloss Enamel (Urethane Modified) 12 Series."
      2) ICI: "ICI Alkyd Industrial Enamel 4308."
      3) Moore: "Urethane Alkyd Gloss M22."
      4) PPG: "Pittsburgh Paints Interior/Exterior Industrial Gloss Oil 7-282 Series."
      5) Porter: "PorterGuard Alkyd Gloss Enamel 2700 Series."
      6) P&L: "Effecto Enamel."
      7) S-W: "Industrial Enamel B54 Series."
3. Aluminum:
   a. One coat of primer.
      1) Duron: "Dura Clad Alkyd White Metal Primer 30-010."
      2) ICI: "ICI All-Purpose Metal Primer 4120."
      3) Moore: "Acrylic Metal Primer M04."
      4) PPG: "Multiprime Quick Dry Universal Primer 97-680 Series."
      5) Porter: "PorterGuard Alkyd Metal Primer 272/276."
      6) P&L: "Effecto Primer Red or White."
      7) S-W: "Galvite HS B50WZ30."
   b. Two coats of gloss enamel.
      1) Duron: "Dura Clad Alkyd Gloss Enamel (Urethane Modified) 12 Series."
      2) ICI: "ICI Alkyd Industrial Enamel 4308."
      3) Moore: "Urethane Alkyd Gloss M22."
      4) PPG: "Pittsburgh Paints Interior/Exterior Industrial Gloss Oil 7-282 Series."
      5) Porter: "PorterGuard Alkyd Gloss Enamel 2700 Series."
      6) P&L: "Effecto Enamel."
      7) S-W: "Industrial Enamel B54 Series."
4. Concrete:
   a. Flat Latex Finish: Two coats of flat latex.
      1) Duron: "Ultra Deluxe Exterior 100% Acrylic Latex Flat House Paint 66 Series."
      2) ICI: "ICI Flat Acrylic Latex 2200."
      3) Moore: "Super Spec 100% Acrylic Exterior Flat #280."
      4) PPG: "Speedhide Exterior Flat Acrylic Latex 6-610 Series."
      5) Porter: "AcriPro 100 Exterior 100% Acrylic Flat 930."
      6) P&L: "Vapex Flat House Paint."
      7) S-W: "A-100 Latex House and Trim Paint A6 Series."
   b. Gloss Enamel Finish:
      1) One coat of primer.
         (a) Duron: "Acrylic Enamel Undercoater 04-123."
         (b) ICI: "ICI Latex Wall Paint Primer-Sealer 1110."
         (c) Moore: "Super Spec Primer & Wall Sealer #253."
         (d) PPG: "Speedhide Interior Latex Sealer Quick Drying 6-2."

(e) Porter: “ProMaster 2000 Latex Primer 867.”
(f) P&L: “Vapex Wall Primer.”
(g) S-W: “PrepRite 200 Interior Latex Primer B28W200.”

2) Two coats of gloss enamel.

(a) Duron: “Dura Clad Alkyd Gloss Enamel (Urethane Modified) 12 Series.”
(b) ICI: “ICI Alkyd Industrial Enamel 4308.”
(c) Moore: “Urethane Alkyd Gloss M22.”
(d) PPG: “Pittsburgh Paints Interior/Exterior Industrial Gloss Oil 7-282 Series.”
(e) Porter: “PorterGuard Alkyd Gloss Enamel 2700 Series.”
(f) P&L: “Effecto Enamel.”
(g) S-W: “Industrial Enamel B54 Series.”

B. Interior Painting Schedule:

1. Ferrous Metal:

a. One coat of primer.

1) Duron: “Dura Clad Alkyd White Metal Primer 30-010.”
2) ICI: “ICI Universal Fast-Dry Metal Primer 4160.”
3) Moore: “Universal Metal Primer M07.”
4) PPG: “Multiprime Quick Dry Universal Primer 97-680 Series.”
5) Porter: “PorterGuard Alkyd Metal Primer 272/276.”
6) P&L: “Effecto Rust-InhibitingPrimer.”
7) S-W: “Kem Kromik Universal Primer.”

b. Two coats of semi-gloss enamel.

1) Duron: “Everlast Interior Alkyd/Oil Semi-Gloss Enamel 43 Series.”
2) ICI: “ICI Semi-Gloss 1507.”
3) Moore: “Super Spec Alkyd Semi-Gloss #271.”
4) PPG: “Speedhide Interior Enamel Semi-Gloss Oil 6-1110 Series.”
5) Porter: “ProMaster 2000 Alkyd Semi-Gloss Enamel 149.”
6) P&L: “Cellu-Tone Alkyd Satin Enamel.”
7) S-W: “ProMar 200 Interior Alkyd Semi-Gloss Enamel B34 Series.”

2. Galvanized Metal:

a. One coat of primer.

1) Duron: “Dura Clad Acrylic Galvanized Metal Primer White 33-100.”
2) ICI: “ICI All-Purpose Metal Primer 4120.”
3) Moore: “Acrylic Metal Primer M04.”
4) PPG: “Pitt-Tech Primer/Finish DTM Acrylic Enamel 90-708 Series.”
5) Porter: “PorterGuard DTM Acrylic Metal Primer 215.”
6) P&L: “Noxide Protective Coating Galvanized Metal Primer.”
7) S-W: “Galvite HS B50WZ30.”

b. Two coats of semi-gloss enamel.

1) Duron: “Everlast Interior Alkyd/Oil Semi-Gloss Enamel 43 Series.”
2) ICI: “ICI Semi-Gloss 1507.”
3) Moore: “Super Spec Alkyd Semi-Gloss #271.”
4) PPG: “Speedhide Interior Enamel Semi-Gloss Oil 6-1110 Series.”
5) Porter: “ProMaster 2000 Alkyd Semi-Gloss Enamel 149.”
6) P&L: “Cellu-Tone Alkyd Satin Enamel.”
7) S-W: “ProMar 200 Interior Alkyd Semi-Gloss Enamel B34 Series.”

3. Aluminum:
   a. One coat of primer.
      1) Duron: “Dura Clad Alkyd White Metal Primer 30-010.”
      2) ICI: “ICI All-Purpose Metal Primer 4120.”
      3) Moore: “Acrylic Metal Primer M04.”
      4) PPG: “Multiprime Quick Dry Universal Primer 97-680 Series.”
      5) Porter: “PorterGuard Alkyd Metal Primer 272/276.”
      6) P&L: “Effecto Primer Red or White.”
      7) S-W: “Galvite HS B50WZ30.”
   b. Two coats of semi-gloss enamel.
      1) Duron: “Everlast Interior Alkyd/Oil Semi-Gloss Enamel 43 Series.”
      2) ICI: “ICI Semi-Gloss 1507.”
      3) Moore: “Super Spec Alkyd Semi-Gloss #271.”
      4) PPG: “Speedhide Interior Enamel Semi-Gloss Oil 6-1110 Series.”
      5) Porter: “ProMaster 2000 Alkyd Semi-Gloss Enamel 149.”
      6) P&L: “Cellu-Tone Alkyd Satin Enamel.”
      7) S-W: “ProMar 200 Interior Alkyd Semi-Gloss Enamel B34 Series.”
4. Gypsum Board:
   a. Flat Latex Finish:
      1) One coat of primer.
         (a) Duron: “Interior Acrylic Latex Drywall Primer 04-124.”
         (b) ICI: “ICI Primer 1030.”
         (c) Moore: “Super Spec Primer & Wall Sealer #253.”
         (d) PPG: “Speedhide Interior Latex Sealer Quick Drying 6-2.”
         (e) Porter: “ProMaster 2000 Latex Primer 867.”
         (f) P&L: “Latex Wall Primer Z30001.”
         (g) S-W: “PrepRite 200 Interior Latex Primer B28W200.”
      2) Two coats of flat latex.
         (a) Duron: “Ultra Deluxe Interior Acrylic Latex Flat 44 Series.”
         (b) ICI: “ICI Latex Wall Paint 1201.”
         (c) Moore: “Super Spec Vinyl Latex Flat #275.”
         (d) PPG: “Speedhide Interior Wall Flat Latex 6-70 Series.”
         (e) Porter: “ProMaster 2000 Interior Acrylic Flat 6109.”
         (f) P&L: “Vapex Latex Wall Finish.”
         (g) S-W: “ProMar 200 Interior Latex Flat B30W200 Series.”
   b. Eggshell Enamel Finish:
      1) One coat of primer.
         (a) Duron: “Interior Acrylic Latex Drywall Primer 04-124.”
         (b) ICI: “ICI Primer 1030.”
         (c) Moore: “Super Spec Primer & Wall Sealer #253.”
         (d) PPG: “Speedhide Interior Latex Sealer Quick Drying 6-2.”
         (e) Porter: “ProMaster 2000 Latex Primer 867.”
         (f) P&L: “Latex Wall Primer Z30001.”
         (g) S-W: “PrepRite 200 Interior Latex Primer B28W200.”
      2) Two coats of eggshell enamel.
         (a) Duron: “Everlast Interior Alkyd/Oil Eggshell Enamel 40 Series.”
         (b) ICI: “ICI Alkyd Eggshell Enamel 1512.”
         (c) Moore: “Dulamel Eggshell Finish #305.”

(d) PPG: "Speedhide Interior Enamel Lo-Sheen Oil 6-90 Series."
(e) Porter: "ProMaster 2000 Alkyd Satin Enamel 129."
(f) P&L: "Vitralite Enamel."
(g) S-W: "ProMar 200 Alkyd Eggshell Enamel B33 Series."

c. Semi-Gloss Enamel Finish:
1) One coat of primer.
(a) Duron: "Acrylic Enamel Undercoater 04-123."
(b) ICI: "ICI Latex Wall Paint Primer-Sealer 1110."
(c) Moore: "Super Spec Primer & Wall Sealer #253."
(d) PPG: "Speedhide Interior Latex Sealer Quick Drying 6-2."
(e) Porter: "ProMaster 2000 Latex Primer 867."
(f) P&L: "Vapex Wall Primer."
(g) S-W: "PrepRite 200 Interior Latex Primer B28W200."
2) Two coats of semi-gloss enamel.
(a) Duron: "Everlast Interior Alkyd/Oil Semi-Gloss Enamel 43 Series."
(b) ICI: "ICI Semi-Gloss 1507."
(c) Moore: "Super Spec Alkyd Semi-Gloss #271."
(d) PPG: "Speedhide Interior Enamel Semi-Gloss Oil 6-1110 Series."
(e) Porter: "ProMaster 2000 Alkyd Semi-Gloss Enamel 149."
(f) P&L: "Cellu-Tone Alkyd Satin Enamel."
(g) S-W: "ProMar 200 Interior Alkyd Semi-Gloss Enamel B34 Series."

d. Epoxy Finish:
1) One coat of primer.
(a) Duron: "Interior Acrylic Latex Drywall Primer 04-124."
(b) ICI: "ICI Primer 1030."
(c) Moore: "Super Spec Primer & Wall Sealer #253."
(d) PPG: "Speedhide Interior Latex Sealer Quick Drying 6-2."
(e) Porter: "ProMaster 2000 Latex Primer 867."
(f) P&L: "Latex Wall Primer Z30001."
(g) S-W: "PrepRite 200 Interior Latex Primer B28W200."
2) One coat of epoxy.
(a) Duron: "Dura Clad High Solids Polyamide Epoxy Gloss 93-3 Series."
(b) ICI: "ICI 4508."
(c) Moore: "Polyamide Epoxy Semi-Gloss M33/M38."
(d) PPG: "Aquapon WB Water Base Epoxy 98-1 Series."
(e) Porter: "DuraGlaze Polyamide WB Semi-Gloss Epoxy 9321."
(f) P&L: "Vitra-Tile Epoxy."
(g) S-W: "Armor-Tile HS Polyester Epoxy B67-100 Series."

5. Concrete Block:

a. Semi-Gloss Enamel Finish:
1) One coat of primer.
(a) Duron: "Block Kote Latex Block Filler 08-126."
(b) ICI: "ICI Acrylic Latex Block Filler 3010."
(c) Moore: "Latex Block Filler M88."
(d) PPG: "Speedhide Interior/Exterior Masonry Block Filler Latex 6-7."
(e) Porter: "ProMaster 2000 Latex Block Filler 6223."
(f) P&L: "Pro-Hide Plus Block Filler."
(g) S-W: "Heavy-Duty Block Filler B42W46."

2) Two coats of semi-gloss enamel.
   (a) Duron: “Everlast Interior Alkyd/Oil Semi-Gloss Enamel 43 Series.”
   (b) ICI: “ICI Semi-Gloss 1507.”
   (c) Moore: “Super Spec Alkyd Semi-Gloss #271.”
   (d) PPG: “Speedhide Interior Enamel Semi-Gloss Oil 6-1110 Series.”
   (e) Porter: “ProMaster 2000 Alkyd Semi-Gloss Enamel 149.”
   (f) P&L: “Cellu-Tone Alkyd Satin Enamel.”
   (g) S-W: “ProMar 200 Interior Alkyd Semi-Gloss Enamel B34 Series.”

b. Epoxy Finish:
   1) One coat of primer.
      (a) Duron: “Block Kote Latex Block Filler 08-126.”
      (b) ICI: “ICI Acrylic Latex Block Filler 3010.”
      (c) Moore: “Latex Block Filler M88.”
      (d) PPG: “Speedhide Interior/Exterior Masonry Block Filler Latex 6-7.”
      (e) Porter: “ProMaster 2000 Latex Block Filler 6223.”
      (f) P&L: “Pro-Hide Plus Block Filler.”
      (g) S-W: “Heavy-Duty Block Filler B42W46.”
   2) One coat of epoxy.
      (a) Duron: “Dura Clad High Solids Polyamide Epoxy Gloss 93-3 Series.”
      (b) ICI: “ICI 4508.”
      (c) Moore: “Polyamide Epoxy Semi-Gloss M33/M38.”
      (d) PPG: “Aquapon WB Water Base Epoxy 98-1 Series.”
      (e) Porter: “DuraGlaze Polyamide WB Semi-Gloss Epoxy 9321.”
      (f) P&L: “Vitra-Tile Epoxy.”
      (g) S-W: “Armor-Tile HS Polyester Epoxy B67-100 Series.”

6. Concrete:
   a. Flat Latex Finish: Two coats of flat latex.
      1) Duron: “Ultra Deluxe Interior Acrylic Latex Flat 44 Series.”
      2) ICI: “ICI Latex Wall Paint 1201.”
      3) Moore: “Super Spec Vinyl Latex Flat #275.”
      4) PPG: “Speedhide Interior Wall Flat Latex 6-70 Series.”
      5) Porter: “ProMaster 2000 Interior Acrylic Flat 6109.”
      6) P&L: “Vapex Latex Wall Finish.”
      7) S-W: “ProMar 200 Interior Latex Flat B30W200 Series.”
   b. Semi-Gloss Enamel Finish:
      1) One coat of primer.
         (a) Duron: “Acrylic Enamel Undercoater 04-123.”
         (b) ICI: “ICI Latex Wall Paint Primer-Sealer 1110.”
         (c) Moore: “Super Spec Primer & Wall Sealer #253.”
         (d) PPG: “Speedhide Interior Latex Sealer Quick Drying 6-2.”
         (e) Porter: “ProMaster 2000 Latex Primer 867.”
         (f) P&L: “Vapex Wall Primer.”
         (g) S-W: “PrepRite 200 Interior Latex Primer B28W200.”
      2) Two coats of semi-gloss enamel.
         (a) Duron: “Everlast Interior Alkyd/Oil Semi-Gloss Enamel 43 Series.”
         (b) ICI: “ICI Semi-Gloss 1507.”
         (c) Moore: “Super Spec Alkyd Semi-Gloss #271.”
         (d) PPG: “Speedhide Interior Enamel Semi-Gloss Oil 6-1110 Series.”
         (e) Porter: “ProMaster 2000 Alkyd Semi-Gloss Enamel 149.”
         (f) P&L: “Cellu-Tone Alkyd Satin Enamel.”
         (g) S-W: “ProMar 200 Interior Alkyd Semi-Gloss Enamel B34 Series.”

7. Wood:
   a. Transparent Finish:
      1) One coat of stain.
         (a) Duron: “Interior Penetrating Oil Wood Stain 28 Series.”
         (b) ICI: “ICI Interior Oil Wood Stain 1700.”
         (c) Moore: “Benwood Interior Finishes #234.”
         (d) PPG: “REZ Interior Stain Semi-Transparent Oil 77-560.”
         (e) Porter: “Wood Guardian Interior Oil Wood Stain 832.”
         (f) P&L: “Tonetic Wood Stain.”
         (g) S-W: “Wood Classics Interior Stain A48-200 Series.”
      2) One coat of sanding sealer.
         (a) Duron: “Kwik Seal Interior Clear Polyurethane Sealer/Finish 15-017.”
         (b) ICI: “ICI Quick Drying Sanding Sealer 1916.”
         (c) Moore: “Super Spec Sanding Sealer #267.”
         (d) PPG: “Speedhide Interior Wood Sanding Sealer 6-10.”
         (e) Porter: “Wood Guardian Fast Dry Sanding Sealer 671.”
         (f) P&L: “Sanding Sealer.”
         (g) S-W: “Wood Classics FastDry Sanding Sealer B26V43.”
      3) Two coats of varnish.
         (a) Duron: “Permathane Interior Polyurethane Satin Finish 15-011.”
         (b) ICI: “ICI Urethane Varnish 1902.”
         (c) Moore: “Benwood One Hour Clear Finish #420.”
         (d) PPG: “REZ Interior Polyurethane Satin Varnish 77-89.”
         (e) Porter: “Wood Guardian Satin Varnish 831.”
         (f) P&L: “Varmor Clear Finish Satin.”
         (g) S-W: “Wood Classics Polyurethane Varnish 67 Series.”
   b. Opaque Finish:
      1) One coat of primer.
         (a) Duron: “Wall Kote Interior Alkyd Enamel Undercoater 04-024.”
         (b) ICI: “ICI Wood Undercoater 1020.”
         (c) Moore: “Super Spec Alkyd Enamel Undercoater #245.”
         (d) PPG: “Speedhide Interior Undercoater and Primer Alkyd 6-6.”
         (e) Porter: “ProMaster 2000 Alkyd Enamel Undercoat 6064.”
         (f) P&L: “Interior Trim Primer.”
         (g) S-W: “ProMar 200 Alkyd Enamel Undercoater B49W200.”
      2) Two coats of semi-gloss enamel.
         (a) Duron: “Everlast Interior Alkyd/Oil Semi-Gloss Enamel 43 Series.”
         (b) ICI: “ICI Semi-Gloss 1507.”
         (c) Moore: “Super Spec Alkyd Semi-Gloss #271.”
         (d) PPG: “Speedhide Interior Enamel Semi-Gloss Oil 6-1110 Series.”
         (e) Porter: “ProMaster 2000 Alkyd Semi-Gloss Enamel 149.”
         (f) P&L: “Cellu-Tone Alkyd Satin Enamel.”
         (g) S-W: “ProMar 200 Interior Alkyd Semi-Gloss Enamel B34 Series.”

END OF SECTION 09900

SECTION 10160 - METAL TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Metal toilet compartments.

B. Urinal screens.

1.2 RELATED REQUIREMENTS

A. Section 05500 - Metal Fabrications: Concealed steel support members.

B. Section 06100 - Rough Carpentry: Blocking and supports.

C. Section 10800 - Toilet, Bath, and Laundry Accessories.

1.3 REFERENCE STANDARDS

A. ASTM A424 - Standard Specification for Steel, Sheet, for Porcelain Enameling; 2009a.

B. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2009a.

C. ASTM A 666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2003.

1.4 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall supports, door swings.

C. Product Data: Provide data on panel construction, hardware, and accessories.

D. Manufacturer's Installation Instructions: Indicate special procedures.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Metal Toilet Compartments:
   1. General Partitions Mfg. Corp: www.generalpartitions.com.
   2. Global Steel Products Corp: www.globalpartitions.com.
   3. Metpar Corp: www.metpar.com.
   4. Sanymetal, A Crane Plumbing Company: www.sanymetal.com.
   5. Substitutions: Section 01600 - Product Requirements.

2.2 MATERIALS

A. Steel Sheet: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.

B. Stainless Steel Sheet: ASTM A666, Type 304.

2.3 COMPONENTS

A. Toilet Compartments: Stainless steel, floor-mounted headrail-braced.

B. Doors, Panels, and Pilasters: Sheet steel faces, pressure bonded to sound deadening core, formed and closed edges; corners made with corner clips or mitered, welded, and ground smooth.

1. Panel Faces: 20 gage.
2. Door Faces: 22 gage.
3. Pilaster Faces: 20 gage.
4. Reinforcement: 12 gage.
5. Internal Reinforcement: Provide in areas of attached hardware and fittings. Mark locations of reinforcement for partition mounted washroom accessories.

C. Door and Panel Dimensions:

1. Thickness: 1 inch.
2. Door Width: 24 inch.
3. Door Width for Handicapped Use: 36 inch, out-swinging.
4. Height: 58 inch.

D. Pilasters: 1-1/4 inch thick, of sizes required to suit compartment width and spacing.

E. Urinal Screens: Wall mounted with two panel brackets, and floor-to-ceiling vertical upright consisting of pilaster anchored to floor and ceiling.

2.4 ACCESSORIES

A. Pilaster Shoes: Formed ASTM A 666, Type 304 stainless steel with No. 4 finish, 3 inch high, concealing floor fastenings.

B. Head Rails: Hollow stainless steel tube, 1 x 1-5/8 inch size, with anti-grip strips and cast socket wall brackets.

C. Brackets: Satin stainless steel.

D. Attachments, Screws, and Bolts: Stainless steel, tamper proof type.

1. For attaching panels and pilasters to brackets: Through-bolts and nuts; tamper proof.

E. Hardware: Satin chrome plated non-ferrous cast metal:

1. Pivot hinges, gravity type, adjustable for door close positioning; two per door.
2. Thumb turn or sliding door latch with exterior emergency access feature.
3. Door strike and keeper with rubber bumper; mounted on pilaster in alignment with door latch.
4. Coat hook with rubber bumper; one per compartment, mounted on door.
5. Provide door pull for outswinging doors.

2.5 FINISHING

A. Stainless Steel Compartments: No. 4 finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that field measurements are as indicated.

C. Verify correct spacing of and between plumbing fixtures.

D. Verify correct location of built-in framing, anchorage, and bracing.

3.2 INSTALLATION

A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.

B. Maintain 3/8 to 1/2 inch space between wall and panels and between wall and end pilasters.

C. Attach panel brackets securely to walls using anchor devices.

D. Attach panels and pilasters to brackets. Locate head rail joints at pilaster center lines.

E. Field touch-up of scratches or damaged enamel finish will not be permitted. Replace damaged or scratched materials with new materials.

3.3 TOLERANCES

A. Maximum Variation From True Position: 1/4 inch.

B. Maximum Variation From Plumb: 1/8 inch.

3.4 ADJUSTING

A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch.

B. Adjust hinges to position doors in partial opening position when unlatched. Return out swinging doors to closed position.

C. Adjust adjacent components for consistency of line or plane.

END OF SECTION 10160

SECTION 10210 - WALL LOUVERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Louvers, frames, and accessories.

1.2 RELATED REQUIREMENTS

A. Section 07620 - Sheet Metal Flashing and Trim.

B. Section 07900 - Joint Sealers.

C. Section 15810 - Ducts: Ductwork attachment to louvers.

1.3 REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; American Architectural Manufacturers Association; 1998.

B. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels; 2005.

C. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating; Air Movement and Control Association International, Inc.; 2007.

D. AMCA 511 - Certified Ratings Program for Air Control Devices; Air Movement and Control Association International, Inc.; 2010.

1.4 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data describing design characteristics, maximum recommended air velocity, design free area, materials and finishes.

C. Shop Drawings: Indicate louver layout plan and elevations, opening and clearance dimensions, tolerances; head, jamb and sill details; blade configuration, screens, blankout areas required, and frames.

D. Test Reports: Independent agency reports showing compliance with specified performance criteria.

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

1.5 QUALITY ASSURANCE

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

1.6 WARRANTY

A. See Section 01780 - Closeout Submittals, for additional warranty requirements.

B. Provide twenty year manufacturer warranty against distortion, metal degradation, and failure of connections.
1. Finish: Include coverage against degradation of exterior finish.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Wall Louvers:
1. Airolite Company, LLC: www.airolite.com.
2. Construction Specialties, Inc: www.c-sgroup.com.
3. PCI Industries, Inc; All-Lite Brand: www.alllite-louvers.com.
4. Substitutions: See Section 01600 - Product Requirements.

2.2 LOUVERS

A. Louvers: Factory fabricated and assembled, complete with frame, mullions, and accessories; AMCA Certified under AMCA 511.
1. Wind Load Resistance: Design to resist positive and negative wind load of 25 psf without damage or permanent deformation.
2. Intake Louvers: Design to allow maximum of 0.01 oz/sq ft water penetration at calculated intake design velocity based on design air flow and actual free area, when tested in accordance with AMCA 500-L.
3. Drainable Blades: Continuous rain stop at front or rear of blade aligned with vertical gutter recessed into both jambs of frame.
4. Screens: Provide insect screens at intake louvers and bird screens at exhaust louvers.

B. Stationary Louvers: Horizontal blade, extruded aluminum construction, with intermediate mullions matching frame.
1. Free Area: 50 percent, minimum.
2. Blades: Straight.
3. Frame: 4 inches deep, channel profile; corner joints mitered and mechanically fastened, with continuous recessed caulking channel each side.
4. Metal Thickness: Frame 0.081 inch; blades 0.081 inch.
5. Finish: Fluoropolymer coating, finished after fabrication.
6. Color: Custom, to match approved sample.

2.3 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M),.
1. Color Anodizing: AAMA 611 Class I, AA-M12C22A42/44.

B. Bird Screen: Interwoven wire mesh of steel, 0.063 inch diameter wire, 1/2 inch open weave, diagonal design.

C. Insect Screen: 18 x 16 size aluminum mesh.

D. Polyvinylidene Fluoride Coating: Minimum 70 percent Kynar 500/Hylar 500 resin, two coat finish, complying with AAMA 2604.

2.4 ACCESSORIES

A. Blank-Off Panels: Same material as louver, painted black on exterior side; provide where duct connected to louver is smaller than louver frame, sealing off louver area outside duct.

B. Screens: Frame of same material as louver, with reinforced corners; removable, screw attached; installed on inside face of louver frame.

C. Fasteners and Anchors: Galvanized steel.

D. Head and Sill Flashings: See Section 07620.

E. Sealant: type as specified in Section 07900.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that prepared openings and flashings are ready to receive work and opening dimensions are as indicated on shop drawings.

B. Verify that field measurements are as indicated.

3.2 INSTALLATION

A. Install louver assembly in accordance with manufacturer's instructions.

B. Coordinate with installation of flashings by others.

C. Install louvers level and plumb.

D. Align louver assembly to ensure moisture shed from flashings and diversion of moisture to exterior.

E. Secure louver frames in openings with concealed fasteners.

F. Install perimeter sealant and backing rod in accordance with Section 07900.

G. Coordinate with installation of mechanical ductwork.

3.3 CLEANING

A. Strip protective finish coverings.

B. Clean surfaces and components.

END OF SECTION 10210

SECTION 10270 - ACCESS FLOORING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Structural floor supported pedestal framing system.

B. Removable floor panels.

C. System electrostatic grounding.

1.2 RELATED REQUIREMENTS

A. Section 01616 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 07900 - Joint Sealers.

C. Section 09625 - Resilient Athletic Flooring: Finish for access flooring panels.

1.3 REFERENCE STANDARDS

A. ANSI/ICC A117.1 - American National Standard for Accessible and Usable Buildings and Facilities; International Code Council; 2003.

B. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2010.

C. CISCA (AF) - Recommended Test Procedures for Access Floors; Ceilings & Interior Systems Construction Association; 2004.

D. NFPA 75 - Standard for the Protection of Information Technology Equipment; National Fire Protection Association; 2009.

E. NFPA 99 - Standard for Health Care Facilities; National Fire Protection Association; 2005.

F. UL (FRD) - Fire Resistance Directory; Underwriters Laboratories Inc.; current edition.

1.4 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for grid system, panels, and accessories; electrical resistance characteristics and ground connection requirements.

C. Shop Drawings: Indicate floor layout, interruptions to grid, special sized panels, panels requiring drilling or cut-out for services, appurtenances or interruptions, edge details, elevation differences, ramps, grilles, and registers.

D. Samples: Submit two samples of floor grid and panel, 12 x12 inch in size illustrating finishes and color.

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

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 01600 - Product Requirements, for additional provisions.
2. Extra Floor Panels: Four of each size.
3. Extra Pedestals and Stringers: Four each.
4. Panel Lifting Devices: One, of manufacturer's standard type.

G. LEED Submittal: Documentation of recycled content and location of manufacture.

1.5 QUALITY ASSURANCE

A. Designer Qualifications: Design floor system structure layout for this project under direct supervision of a Professional Structural Engineer experienced in design of floors of the type required and licensed in Alabama.

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Access Flooring:
1. Free Axez USA: www.freeaxez.com.
2. Haworth: www.haworth.com.
3. Tate Access Floors, Inc: www.tateaccessfloors.com.
4. Substitutions: See Section 01600 - Product Requirements.

2.2 ACCESS FLOORING

A. Access Flooring: Factory-fabricated system consisting of removable floor panels and supporting structure that allows access to each space below floor without requiring removal of panels other than the one directly above the space to which access is needed; provide all components and accessories required for complete installation and as indicated.
1. Configuration: Clamped stringer system.
2. Finished Floor Elevation: Top of access floor nominal height above building structural floor shall be as indicated on the Drawings.
3. Floor Panel Size: 24 x 24 inches.

B. Basis of Design: Tate Access Floors, Inc. All Steel 1500 Access Floor Panel Bolted Stringer Understructure System

C. Performance Requirements:
1. Pedestals:
a. Maximum Axial Load: 5,000 lb without permanent deformation.
b. Ultimate Strength: Not less than twice design load.
2. Floor Panels: Conform to the following:
a. Live Load: 250 lb/sq ft.
b. Maximum Deflection: 0.04 inch.
c. Concentrated Load: 1,000 lb on 1 sq in at any location with maximum deflection of 0.08 inch.
d. Permanent Deformation: 0.02 inch maximum at design load.
e. Ultimate Strength: Not less than twice design load.
f. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
3. Lateral Stability: Design system for lateral stability in all directions, with or without panels in place.
4. Surface Electrical Resistance: Maximum 1 ohm per panel.

2.3 COMPONENTS

A. Pedestals: Steel with flat bottom base plate, threaded supporting rod, vibration proof lock nut to permit 1-1/2 inch adjustment, galvanized finish.

B. Frame Grid Stringers: Continuous type, consisting of steel channels, box, or tee sections.

C. Floor Panels:
1. Die formed galvanized steel top and bottom plates; steel reinforcement stiffeners.
2. Panel Edge: Vinyl trim, slip-on type.
3. Floor Panel Finish Adhesive: Moisture resistant type recommended by floor finish manufacturer.

2.4 ACCESSORIES

A. Electrostatic Grounding Connectors: Solid copper.

B. Cable Cutout Protection: Extruded polyvinyl chloride edging, self-extinguishing.

C. Wall Base: Extruded plastic angles.

D. Sealant: Type as specified in Section 07900.

2.5 FINISHES

A. Floor Panel Finish:
1. Resilient Athletic tile, static conductive type 1/8 inch thick, as specified in Section 09625; color as indicated.

B. Exposed Metal Surfaces: Baked enamel finish; color as selected.

C. Facia Panel: Baked enamel finish; color as selected.

2.6 SOURCE QUALITY CONTROL

A. Fabrication Tolerances:
1. Floor Panel Flatness: Plus or minus 0.02 inch in any direction.
2. Floor Panel Width or Length From Specified Size: Plus or minus 0.02 inch.
3. Floor Panel Squareness: Plus or minus 0.03 inch difference between opposite diagonal dimensions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify field measurements are as shown on shop drawings.

B. Verify that required utilities are available, in proper location, and ready for use.

3.2 PREPARATION

A. Vacuum clean substrate surfaces.

3.3 INSTALLATION

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

B. Secure pedestal base plate to subfloor with adhesive.

C. Install additional pedestals where grid pattern is interrupted by room appurtenances or at cut-outs.

D. Install stringers and floor panels on pedestals with full bearing.

E. Close field cut floor panels with edge trim.

F. Provide positive electrical earth grounding of entire floor assembly in accordance with NFPA 75.

3.4 TOLERANCES

A. Maximum Out of Level Floor Panel Tolerance: 1/16 inch in 10 ft, non-cumulative.

3.5 ADJUSTING

A. Adjust pedestals to achieve a level floor and to assure adjacent floor panel surfaces are flush.

3.6 PROTECTION

A. Do not permit traffic over unprotected floor surface.

END OF SECTION 10270

SECTION 10400 - IDENTIFICATION DEVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Room and door signs.

1.2 REFERENCE STANDARDS

A. ANSI/ICC A117.1 - American National Standard for Accessible and Usable Buildings and Facilities; International Code Council; 2003.

B. ATBCB ADAAG - Americans with Disabilities Act Accessibility Guidelines; 2002.

1.3 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.

C. Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.

1. When room numbers to appear on signs differ from those on the drawings, include the drawing room number on schedule.
2. When content of signs is indicated to be determined later, request such information from Owner through Architect at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
3. Submit for approval by Owner through Architect prior to fabrication.

D. Samples: Submit two samples of each type of sign, of size similar to that required for project, illustrating sign style, font, and method of attachment.

E. Selection Samples: Where colors are not specified, submit two sets of color selection charts or chips.

F. Verification Samples: Submit samples showing colors specified.

G. Manufacturer's Installation Instructions: Include installation templates and attachment devices.

1.4 QUALITY ASSURANCE

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

1.5 DELIVERY, STORAGE, AND HANDLING

A. Package signs as required to prevent damage before installation.

B. Package room and door signs in sequential order of installation, labeled by floor or building.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Flat Signs:
1. Best Sign Systems, Inc: www.bestsigns.com.
2. Mohawk Sign Systems, Inc: www.mohawksign.com.
3. Seton Identification Products: www.seton.com/aec.

2.2 SIGNAGE APPLICATIONS

A. Accessibility Compliance: All signs are required to comply with ADAAG and ANSI/ICC A 117.1 and applicable building codes, unless otherwise indicated; in the event of conflicting requirements, comply with the most comprehensive and specific requirements.

B. Room and Door Signs: Provide a sign for every doorway, whether it has a door or not, not including corridors, lobbies, and similar open areas.
1. Sign Type: Flat signs with engraved panel media as specified.
2. Provide "tactile" signage, with letters raised minimum 1/32 inch and Grade II braille.
3. Character Height: 1 inch.
4. Sign Size: Refer to Drawings for sign details and dimensions.
5. Office Doors: Identify with room numbers to be determined later, not the numbers shown on the drawings; in addition, provide "window" section for replaceable occupant name.
6. Conference and Meeting Rooms: Identify with room numbers to be determined later, not the numbers shown on the drawings; in addition, provide "window" section with sliding "In Use/Vacant" indicator.
7. Service Rooms: Identify with room names and numbers to be determined later, not those shown on the drawings.
8. Rest Rooms: Identify with pictograms, the names "MEN" and "WOMEN", room numbers to be determined later, and braille.

2.3 SIGN TYPES

A. Flat Signs: Signage media in aluminum frame.
1. Edges: Square.
2. Corners: Square.
3. Frame Finish: Natural (clear) anodized.
4. Clear Cover: For customer produced sign media, provide clear cover of polycarbonate plastic, glossy on back, non-glare on front.
5. Wall Mounting of One-Sided Signs: Concealed screws.

B. Color and Font: Unless otherwise indicated:
1. Character Font: Helvetica, Arial, or other sans serif font.
2. Character Case: Upper case only.
3. Background Color: Color to be selected from manufacturer's standard.
4. Character Color: Contrasting color.

2.4 ACCESSORIES

A. Concealed Screws: Stainless steel, galvanized steel, chrome plated, or other non-corroding metal.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 INSTALLATION

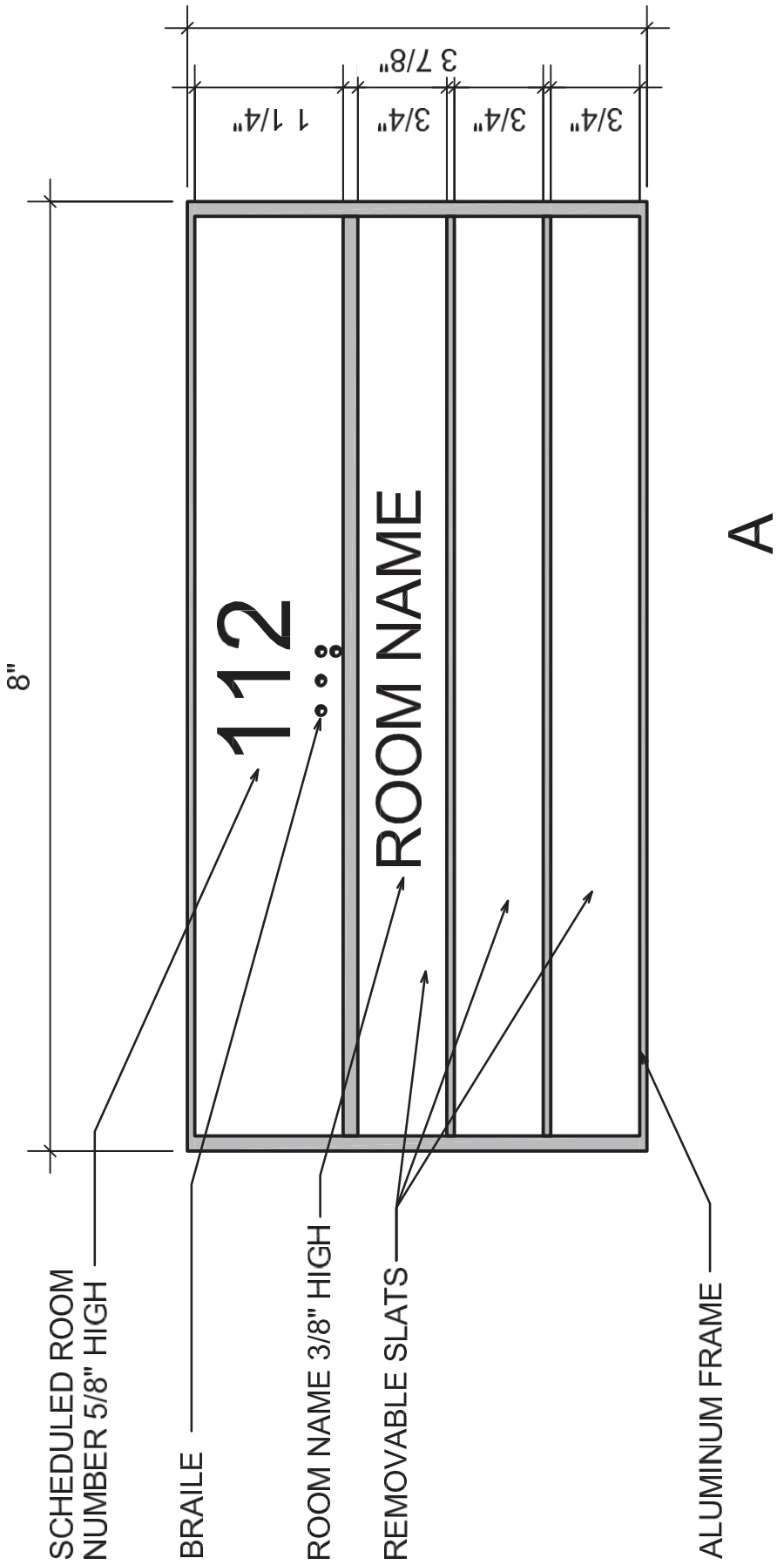
A. Install in accordance with manufacturer's instructions.

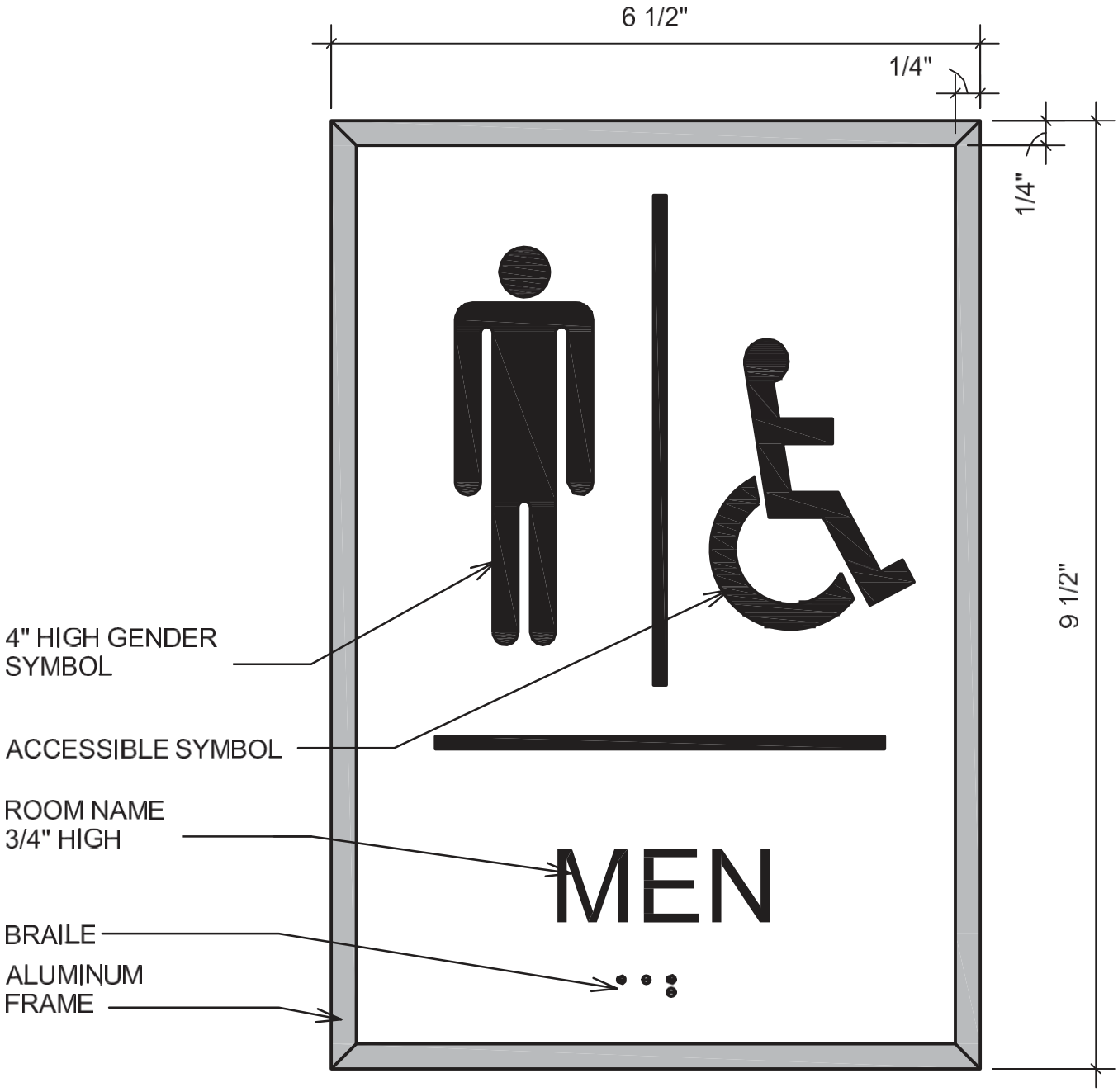
B. Install neatly, with horizontal edges level.

C. Locate signs where indicated:
   1. Room and Door Signs: Locate on wall at latch side of door with centerline of sign at 60 inches above finished floor.
   2. If no location is indicated obtain Owner's instructions.

D. Protect from damage until Substantial Completion; repair or replace damage items.

END OF SECTION 10400


3 7/8"
1 1/4"
3/4"
3/4"
3/4"
8"
112
ROOM NAME
A
SCHEDULED ROOM NUMBER 5/8" HIGH
BRAILE
ROOM NAME 3/8" HIGH
REMOVABLE SLATS
ALUMINUM FRAME


6 1/2"
1/4"
1/4"
9 1/2"
4" HIGH GENDER SYMBOL
ACCESSIBLE SYMBOL
ROOM NAME 3/4" HIGH
MEN
BRAILE
ALUMINUM FRAME

SECTION 10523 - FIRE EXTINGUISHERS, CABINETS AND ACCESSORIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Fire extinguishers.

B. Fire extinguisher cabinets.

C. Accessories.

1.2 RELATED REQUIREMENTS

A. Section 06100 - Rough Carpentry: Wood blocking product and execution requirements.

B. Section 09900 - Paints and Coatings: Field paint finish.

1.3 REFERENCE STANDARDS

A. NFPA 10 - Standard for Portable Fire Extinguishers; 2010.

B. UL (FPED) - Fire Protection Equipment Directory; Underwriters Laboratories Inc.; current edition.

1.4 SUBMITTALS

A. See Section 01300 - 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.

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

1.5 FIELD CONDITIONS

A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Fire Extinguisher, Cabinets and Accessories:
   1. JL Industries, Inc: www.jlindustries.com.
   2. Larsen's Manufacturing Co: www.larsensmfg.com.
   3. Potter-Roemer: www.potterroemer.com.
   4. Substitutions: See Section 01600 - Product Requirements.

2.2 FIRE EXTINGUISHERS

A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.

B. Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gage.
1. Cartridge Operated: Spun shell.
2. Class: A:B:C.
3. Size: 10 pound.

2.3 FIRE EXTINGUISHER CABINETS

A. Metal: Formed stainless steel sheet; 0.036 inch thick base metal.

B. Cabinet Configuration: Semi-recessed type.
1. Sized to accommodate accessories.
2. Exterior nominal dimensions of 9-1/2" wide x 24" high x 6" deep.
3. Trim: Returned to wall surface, with 1" projection, 2" wide face.
4. Form cabinet enclosure with right angle inside corners and seams. Form perimeter trim and door stiles.

C. Door: 0.036 inch 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 thick float. Set in resilient channel gasket glazing.

E. Cabinet Mounting Hardware: Appropriate to cabinet. Pre-drill for anchors.

F. Weld, fill, and grind components smooth.

G. Finish of Cabinet Interior: #4 stainless steel.

H. Fire-Rated: Provide fire-rated cabinets where located in rated walls. Refer to Drawings.

2.4 FIRE STANDPIPE VALVE CABINET

A. Product/Manufacturer: Equal to Potter Roemer Company Model #1832.
1. One piece 20 gauge cold-rolled steel door and frame, 22 gauge steel box
2. Door to be reinforced with rigid tubular metal and furnished with continuous steel piano hinge, pin and handle hardware
3. Semi-Recessed cabinet, 1 1/4" trim, box size
4. Box Size: 24" w x 24" h x 10" d
5. Door & Frame Materials: Provide 304 stainless steel (#4 brushed finish)
6. Fire-Rated Option: Fire-Rated cabinets shall be provided for 1 and 2-hour combustible walls. Boxes are double-wall construction, lined with fire resistant material.

2.5 ACCESSORIES

A. Extinguisher Brackets: Formed steel, chrome-plated. extinguishers per floor, no more than 75' apart, 1 direction. Location will be designated later:

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify rough openings for cabinet are correctly sized and located.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install cabinets plumb and level, at height indicated from finished floor to inside bottom of cabinet.

C. Secure rigidly in place.

D. Place extinguishers and accessories in cabinets.

END OF SECTION 10523

SECTION 10651 - OPERABLE PANEL PARTITIONS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Acoustic operable panel partition.

B. Operable partitions, including panels, track, operating hardware, trim and panel finish material as required to furnish a complete operational system with the performance requirements specified herein.

1. All work as shown on the drawings and as specified herein shall be performed by the manufacturer or his authorized representative.

C. Building Structure:

1. Preparation of the opening for the operable partitions as indicated on the drawings and specified herein shall be performed by the General Contractor.
2. Elevation control of the floor shall be + 1/8 inch in twelve feet non-accumulative.
3. Jambs shall be plumb with a maximum variation of plus or minus 1/8 inch in the height of the opening.
4. Plenum barriers above the operable partition shall be constructed by the General Contractor as detailed on the drawings.
5. All construction shall be complete and shall have a finished appearance with smooth corners, and straight flat surfaces.

1.2 RELATED REQUIREMENTS

A. Section 06100 - Rough Carpentry: Wood blocking and track support shimming.

B. Section 06200 - Finish Carpentry: Wood perimeter trim.

C. Section 07900 - Joint Sealers: Acoustical sealant.

1.3 REFERENCE STANDARDS

A. ASTM E 84 -Standard Test Method for Surface Burning Characteristics of Building Materials; 2010.

B. ASTM E 90 -Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009.

C. ASTM E 557 -Standard Guide for The Installation of Operable Partitions; 2000 (Reapproved 2006).

D. ASTM E 596 - Standard Test Method for Laboratory Measurement of Noise Reduction of Sound-Isolating Enclosures; 1996 (Reapproved 2009).

E. ASTM F 793 - Standard Classification of Wallcovering by Use Characteristics; 2007.

F. UL (FRD) - Fire Resistance Directory; Underwriters Laboratories Inc.; current edition.

1.4 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on partition materials.

C. Shop Drawings: Indicate opening sizes, track layout, details of track and required supports, static and dynamic loads, adjacent construction and finish trim, and stacking depth.

D. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Suspended ceiling components.
2. Structural members to which suspension systems will be attached.
3. Size and location of initial access modules for acoustical tile.
4. Items penetrating finished ceiling, including the following:
    a. Lighting fixtures.
    b. Air outlets and inlets.
    c. Speakers.
    d. Sprinklers.
    e. Access panels.

E. Samples for Selection: Submit two samples of full manufacturer's color range for selection of colors.

F. Samples for Review: Submit two samples of surface finish, 12 x 12 inches (300 x 300 mm) size, illustrating quality.

G. Manufacturer's Instructions: Indicate special procedures.

H. Certificates: Certify that partition system meets or exceeds specified acoustic requirements.

I. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods. Describe cleaning materials detrimental to finish surfaces and hardware finish.

1.5 LABORATORY SOUND PERFORMANCE:

A. Operable partitions shall have a laboratory sound transmission class (STC) rating of 50 or higher. The successful bidder shall provide written documentation of laboratory-conducted sound transmission loss tests which resulted in the submitted rating. The tests shall have been conducted in a NVLAP certified independent acoustical laboratory in accordance with the latest version of ASTM E90. Test results shall be submitted to the Architect and Acoustical Consultant for approval.

B. If laboratory test results are not available, the manufacturer may submit field sound isolation test results from at least two (2) field installations of the operable partition type specified herein, for consideration. These tests shall have been conducted by an independent acoustical consultant approved by the Architect and project Acoustical Consultant. The sound isolation tests must result in a Noise Isolation Class (NIC) rating at least equal to that defined in the paragraph of this specification entitled AField Sound Performance.

1.6 FIELD SOUND PERFORMANCE:

A. Upon completion of the operable partition installation, the project Acoustical Consultant will conduct field sound isolation tests for the partitions. The building construction surrounding the operable partitions will be examined prior to the tests to determine that construction deficiencies will not adversely affect the operable partition performance.

B. Field sound isolation tests will be conducted in general conformance with the latest versions of ASTM E336 and E413. The operable partitions shall attain a Noise Isolation Class (NIC) rating of 40 or higher. The operable partition manufacturer, or his authorized representative, shall be present during the tests to make adjustments as necessary to correct identified deficiencies.

C. Compensation for the testing service performed by an independent Acoustical Consultant shall be included as a portion of the operable partition bid. If additional testing (or re- testing) is necessary at a later date due to deficiencies in partition construction or installation, or due to installation not having been completed in a timely manner, the fee associated with such additional tests shall also be paid by the successful bidder.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified this section with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of this section with minimum three years of experience.

C. Testing Agency Qualifications: An independent agency or an NVLAP-accredited laboratory. NVLAP-accredited laboratories must document accreditation, based on a "Certificate of Accreditation" and a "Scope of Accreditation," listing the test methods specified.

D. Fire-Test-Response Characteristics: Provide operable panel partitions with the following surface-burning characteristics as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.
3. Fire Growth Contribution: Textile wall coverings complying with acceptance criteria in UBC Standard 8-2.

1.8 PRODUCT HANDLING:

A. Protection:

1. Use all means necessary to protect materials before, during, and after installation, and to protect the installed work and materials of all other trades.

B. Replacements:

1. All partitions shall be inspected upon delivery for damage. In the event of damage make all repairs and replacements as necessary. All repairs shall be approved by the Architect, and accomplished at no additional cost to the owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:
1. Hufcor, Inc: www.hufcor.com.
2. Modernfold, Inc: www.modernfold.com.
3. Panelfold, Inc: www.panelfold.com.
4. Moderco, Inc.

B. Substitutions: See Section 01600 - Product Requirements.

2.2 OPERABLE PARTITIONS:

A. All panels shall utilize an omni-directional or trolley carrier suspension system. Multi-Ball ball-bearing roller carriers will not be acceptable.

B. Panels shall be steel-faced panels with 16-gauge internal steel frame.

C. Panels shall have manually-operable bottom seals and manually-operable top seals.

D. Partitions shall be approximately 4'-0" wide. Exact widths shall be determined by the limitations at each opening.

E. All operable partitions on this project shall be paired panel, center stacking as detailed on drawings.

F. Acceptable products are as noted below, and are subject to the requirements of these

G. specifications:
1. Modernfold - Model 932 (STC-50)
2. Hufcor - 632 (STC-51) or 642 Series (STC-52)

H. Panel Finish: Refer to Finish Schedule on Drawings for operable panel finish. Provide panel manufactuer's Premium Fabric Line.

2.3 FLOOR AND HEAD SEALS:

A. Panels shall have manually-operable bottom (floor) seals and manually-operable top (head) seals, and shall provide sufficient and uniform force to ensure positive seal contact with the intended fixed construction along the full length and thickness of the panel. Seal operation shall use cams or springs, operated by a lever in the edge of the panel.

B. Separate soffits will not be permitted. The plenum barrier is to seal directly to the operable wall track.

2.4 JAMBS:

A. Supply an expanding panel at the stacking end of each opening. At the opposite end of the operable wall, provide a jamb gasket that will provide a positive seal between the end panel and the building structure. See detailed end condition on architectural drawings.

B. Expanding panels shall be spring or cam operated by lever control on the face of the panel that will provide uniform pressure the full height of the partition against the sealing surface.

2.5 STRUCTURAL DEFLECTION COMPENSATION:

A. Structural deflection compensation should not exceed 1-inch. Structural deflection calculations shall be provided by the project Architect. The partition manufacturer shall supply the Architect with the partition load requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Prior to installation of the operable partitions, the installing contractor shall examine all aspects of the general construction which effect the installation of the operable partitions. He shall notify the General Contractor in writing of any problems relating to the operable partitions. Construction problems which make proper installation of the operable partitions difficult or impossible, or which adversely affect the sound isolation of the operable partitions, shall be rectified prior to installing the panels. Verify that required utilities are available, of the correct characteristics, in proper location, and ready for use.

3.2 INSTALLATION

A. Install partition in accordance with manufacturer's instructions and ASTM E 557.

B. Supervision of the installation of the operable partitions shall be by an experienced installation supervisor who is employed directly by the partition manufacturer.

C. Installation of operable partitions shall commence after the floor covering in the opening has been installed. The partition installer shall coordinate his work with all other trades. Damage to installed work shall be avoided.

D. All gaskets, operating mechanisms, panels, and finishes shall be furnished in new and proper operating condition. Defects shall be corrected to the satisfaction of the Architect.

E. Partitions shall be installed in strict accordance with the manufacturer's instructions. Partitions shall be clean and in perfect condition prior to acceptance by Architect.

3.3 ADJUSTING

A. Adjust partition assembly to provide smooth operation from stacked to full open position. Do not over-compress acoustic seals.

B. Visually inspect partition in full extended position for light leaks to identify a potential acoustical leak.

C. Adjust partition assembly to achieve lightproof seal.

3.4 CLEANING

A. Clean finish surfaces and partition accessories.

B. Condition chalkboard surfaces in accordance with manufacturer's instructions.

END OF SECTION 10651

SECTION 10800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Accessories for toilet rooms.

B. Grab bars.

1.2 RELATED REQUIREMENTS

A. Section 08830 - Mirrors: Other mirrors.

B. Section 09300 - Tile: Ceramic washroom accessories.

C. Section 10160 - Metal Toilet Compartments.

1.3 REFERENCE STANDARDS

A. ASTM A 123/A 123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2009.

B. ASTM A 167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip; 1999 (Reapproved 2009).

C. ASTM A 269 - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2008.

D. ASTM A 666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2003.

E. ASTM C 1036 - Standard Specification for Flat Glass; 2006.

F. ASTM C 1503 - Standard Specification for Silvered Flat Glass Mirror; 2001.

1.4 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on accessories describing size, finish, details of function, attachment methods.

C. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Toilet Accessories:
1. A & J Washroom Accessories Inc: www.ajwashroom.com.
2. American Specialties, Inc: www.americanspecialties.com.
3. Bradley Corporation: www.bradleycorp.com.
4. Substitutions: Section 01600 - Product Requirements.

B. All items of each type to be made by the same manufacturer.

2.2 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. Stainless Steel Sheet: ASTM A 666, Type 304.

C. Stainless Steel Tubing: ASTM A 269, Type 304 or 316.

D. Mirror Glass: Float glass, ASTM C 1036 Type I, Class 1, Quality Q2, with silvering, copper coating, and suitable protective organic coating to copper backing in accordance with GSA CID A-A-3002.

E. Adhesive: Two component epoxy type, waterproof.

F. Fasteners, Screws, and Bolts: Hot dip galvanized, tamper-proof, security type.

G. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

2.3 FINISHES

A. Stainless Steel: No. 4 satin brushed finish, unless otherwise noted.

B. Baked Enamel: Pretreat to clean condition, apply one coat primer and minimum two coats epoxy baked enamel.

C. Galvanizing for Items Other than Sheet: Comply with ASTM A 123/A 123M; galvanize ferrous metal and fastening devices.

D. Shop Primed Ferrous Metals: Pretreat and clean, spray apply one coat primer and bake.

E. Back paint components where contact is made with building finishes to prevent electrolysis.

2.4 TOILET ROOM ACCESSORIES

A. Refer to Drawings for Toilet Accessory Schedule.

B. Electric Hair and Hand Dryer:
1. Equal to SMARTdri™ hand dryer manufactured by World Dryer Corporation.
2. Cover constructed of stainless steel with satin finish.
3. Wall mounting plate shall be constructed of die-cast aluminum and the nozzle shall be constructed of die-cast zinc alloy finished in nickle plating.
4. Epoxy painted covers and motor enclosure shall incorporate SteriTouch® antimicrobial technology. The cover shall be attached to the wall mounting plate with tamper-proof screws.
5. Motor shall be a thermally-protected universal brush type motor operating at 23,400 RPM and delivering 100 CFM air flow at a velocity of 265 MPH
6. Dryer shall incorporate a 400 watt heating element constructed of Nichrome wire and protected by an automatic resetting thermal cutoff.
7. Dryer shall be activated by an automatic infrared sensor with a 3 second run-on time and 30 second vandal shut-off. Control board shall contain a motor control switch which can be controlled in either Hi, MED and LOW power settings. Control board shall contain a heater control switch which can be controlled in either ON or OFF position.
8. Dryer shall provide a 41°F temperature rise. Dryer shall have an ingress protection rating IP24. Hand dryers shall be listed under reexamination service of Underwriters Laboratories, Inc.
9. Electrical:
   a. Voltage: 110-120. b. Amps: 3.3- 10.0 c. Watts: 400 – 1200
   b. Hertz: 60.
10. Sound Level:
   a. 73-85 dBA @ operator ear (hands).
   b. 61-73 dBA @ 2 meters (no hands).

C. Mirrors: Stainless steel framed, 6 mm thick float glass mirror.
1. Size: As indicated on Drawings.
2. Frame: 0.05 inch angle shapes, with mitered and welded and ground corners, and tamperproof hanging system; No.4 finish.
3. Backing: Full-mirror sized, minimum 0.03 inch galvanized steel sheet and nonabsorptive filler material.
4. Fixed Tilt Mirrors: Minimum 3 inches tilt from top to bottom.
5. Shelf: Stainless steel; gage and finish to match mirror frame, turned down edges, welded to frame; 5 inches deep, full width of mirror.

D. Grab Bars: Stainless steel, 1-1/4 inches outside diameter, minimum 0.05 inch wall thickness, nonslip grasping surface finish, concealed flange mounting; 1-1/2 inches clearance between wall and inside of grab bar.
1. Length and configuration: As indicated on drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify exact location of accessories for installation.

C. Verify that field measurements are as indicated on drawings.

D. See Section 06100 for installation of blocking, reinforcing plates, and concealed anchors in walls, and ceilings.

3.2 PREPARATION

A. Deliver inserts and rough-in frames to site for timely installation.

B. Provide templates and rough-in measurements as required.

3.3 INSTALLATION

A. Install accessories in accordance with manufacturers' instructions.

B. Install plumb and level, securely and rigidly anchored to substrate.

C. Mounting Heights and Locations: As required by accessibility regulations, as indicated on drawings, and as follows:

END OF SECTION 10800